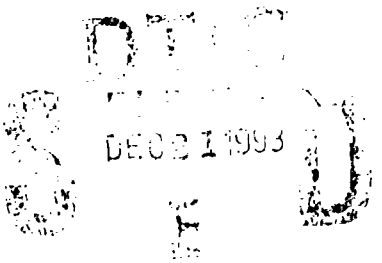
KEEPING THE AIRBORNE DIVISION A VIABLE FORCE

A thesis presented to the faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

JAMES R. LUNSFORD, MAJOR, USA
B.S., Virginia Military Institute, 1980



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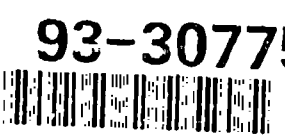

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The airborne division, due to its unique forced entry capabilities, plays a major role in contingency planning. Unfortunately, the current air defense threat may jeopardize the success of future airborne assaults onto defended airfields. Although current doctrine permits airdropping some distance away from the objective and outside the range of the air defense weapons, the airborne division does not have sufficient ground tactical mobility to fully realize this option. This study explores the feasibility of an Enhanced Mobility Airborne Battalion (EMAB) to increase the tactical mobility and lethality of the airborne division. It compares the alternative EMAB with the existing Division Ready Brigade (Medium) by comparing the airlift requirements, aircraft survivability, force lethality, force survivability, and sustainability of the two forces. It concludes that the concept is valid and merits further study.

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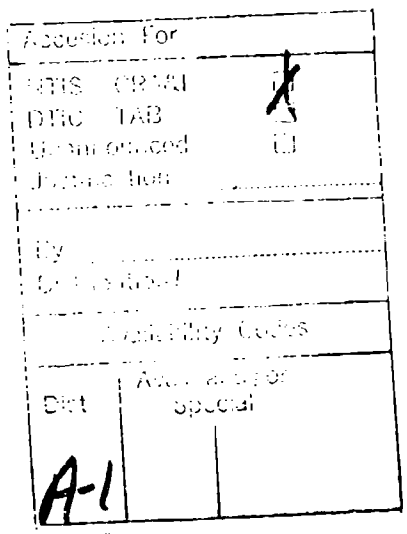

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

KEEPING THE AIRBORNE DIVISION A VIABLE FORCE by MAJ James R. Lunsford, USA, 104 pages.

As the United States transitions towards a national military strategy based on crisis response and forward presence, contingency forces and their capabilities will become increasingly more important. The airborne division, due to its unique forced entry capabilities, plays a major role in contingency planning. In conjunction with U.S. Army rangers, the airborne division can secure a lodgement for follow-on forces by conducting a parachute assault onto an airfield or seaport. Unfortunately, the current air defense threat may jeopardize the success of future airborne assaults onto defended airfields. Although current doctrine permits airdropping some distance away from the objective and outside the range of the air defense weapons, the airborne division does not have sufficient ground tactical mobility to fully realize this option.

This study explores the feasibility of an Enhanced Mobility Airborne Battalion (EMAB) to increase the tactical mobility and lethality of the airborne division. It compares the alternative EMAB with the existing Division Ready Brigade (Medium) by comparing the airlift requirements, aircraft survivability, force lethality, force survivability, and sustainability of the two forces. It concludes that the concept is valid and merits further study.

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INTRODUCTION

Tnis study examines the desirability of developing an Enhanced Mobility Airborne Battalion to enhance the survivability and lethality of the future airborne forces.

Research Question

Would an Enhanced Mobility Airborne Battalion (EMAB) be a more lethal and survivable contingency force than the current airborne Division Ready Brigade (DRB) Medium?

Rationale

The U.S. Army airborne division, composed of three DRBs, is the most responsive division within the Army. Its mission is to deploy lead elements of the division from its home station, within eighteen hours of alert, to conduct a forced entry operation anywhere in the world, to fight, and to win. Due to its high levels of readiness and deployability, the airborne division is often used as an initial response force to a crisis. Unfortunately, the current airborne division structure is not suitable for every contingency; particularly in a mid to high intensity environment against enemy armored forces. There is also the

possibility that the current tactics, techniques, and procedures for employing the airborne division may be obsolete due to improved air defense systems and the lack of organizational ground tactical mobility. Other factors, such as the diminishing size of the USAF transport fleet, may also affect the airborne division's future capabilities.

Ever since its beginnings in World War II, the American airborne division has been organized as a lightly equipped infantry division augmented with airdroppable special weapons, artillery, and support equipment. Due to its unique airborne capability, the division possesses great strategic mobility; being able to land on any suitable drop zone (DZ) within range of its transporting aircraft. However, upon assembling on the ground, the division's tactical mobility has usually been restricted to the speed of its foot mobile infantry.

In the last thirty years, the evolution of the assault helicopter and the addition of an aviation brigade to the airborne division structure have done much to offset shortcomings in the tactical mobility and lethality of the division. However, airdroppable helicopters have not yet been developed. Consequently, during the initial phases of an airborne assault, before helicopters can be employed, a secure airfield must be seized to permit the arrival of the cargo planes which carry the helicopters. The only exception is when the helicopters can self-ferry to the

objective area or can be launched from ships to support the airborne division immediately following the parachute assault. Otherwise, until these helicopters are made ready, the airborne division is still primarily foot mobile. The initial lack of mobility influences the tactics, techniques and procedures of the airborne force.

FM 90-26, "Airborne Operations", lists three methods for conducting a parachute assault: landing or jumping on the objective, near the objective, or some distance away from the objective.[1] Because of the inherent lack of tactical mobility and the emphasis on maintaining surprise, the method most often employed by airborne planners is to jump on the objective. Jumping near the objective is normally conducted when the objective is not an acceptable DZ, such as a bridge or dam. Jumping some distance away from the objective is the least preferred method and is usually only considered in extreme situations. Doing so carries great risks.

Operation *Market Garden*, the 1944 British airborne assault to seize Arnhem bridge, is a historical example of jumping some distance away from the objective. The British parachutists and gliders used a DZ located six miles from their objective. Intercepted by a panzer division while on the move from the DZ to the bridge, the majority of the division was destroyed. Only a small force reached the bridge; where it too was eventually overrun.[2] Though the

DZs were the closest suitable landing areas to Arnhem bridge, the risks of jumping away from the objective were apparent. This lesson has not been forgotten. In order to maximize surprise and reduce the vulnerability of the force, airborne units must airdrop as close to the objective as possible.

Both of the U.S. Army's most recent parachute assaults have been directly on the objectives--runways whose seizure was critical to the success of the operation. In both cases, Grenada and Panama, this requirement stemmed from the need to airland reinforcements as quickly as possible to protect, resupply, and enlarge the airhead. The requirement to quickly seize major airfields has been a mission for the 82d Airborne Division and the Rangers for some time. Each developed plans to conduct this mission using special task organized forces to clear the runway and secure the key facilities so that the first reinforcements could arrive shortly after the parachute assault.

Current planning and training is centered around seizing a large third world airfield because it is one of the most likely contingency missions for the airborne division. In order to project forces quickly, it is necessary to secure a large airfield which can accommodate the large airlift of men and equipment required to achieve decisive victory. The size of the airfield is a limiting factor in the speed of the build-up. Optimally, the

airfield has sufficient length, width, and strength to accommodate all types of USAF transport aircraft. It must have sufficient ramp space and fueling capability to handle the maximum number of aircraft on the ground (MOG) at one time. These stringent parameters limits the number of acceptable airfields for an operation. Most international airports meet the required standards.

Third world countries, probably the most likely location for an airfield seizure mission, possess few airfields which meet the strict criteria needed to support contingency operations. In many cases, there is only one airfield that is acceptable. In these situations, the initial target, for a potential contingency mission relying on airlift, is obvious to both the planners and any reasonably intelligent defender. Maintaining surprise for an operation would be difficult. The enemy would know the location and direction of the airborne assault; only the time of the airdrop could be kept from him.

Surprise is a crucial element in any airborne operation. Airborne units are extremely vulnerable while flying, during the airdrop, and during the initial first hours on the ground. Attacking an airborne force during these times yields the greatest opportunity for success. The German's airborne assault on Crete in 1941 is a perfect example of the risk associated with losing the critical element of surprise. Aware of the German intent to seize

Maleme airfield, the Commonwealth and British defenders organized their defense accordingly. Consequently, they inflicted horrible casualties on the Germans; many of whom died in the flaming wreckage of transport aircraft, were killed during their descent, or were mopped up while they were attempting to assemble into effective combat units. Although the Germans ultimately won, the heavy losses almost cost them the battle.

The potential for disastrous losses is even greater today. Modern air defense artillery (ADA) systems are much more sophisticated than their WWII predecessors. The development of surface to air missiles (SAMs) and radar fire control, so that the ADA can fire in limited visibility, have greatly increased the capabilities of the defender. The small, manportable, shoulder fired SAM is especially a threat to the airborne force since it is hard to locate and destroy with pre-assault fires. Unfortunately, these sophisticated weapons are not just maintained by the larger, more stable countries. Due to the proliferation of arms to third world countries, most armies now possess this capability.

The U.S. military, recognizing this threat, developed defensive and offensive countermeasures to reduce the effectiveness of these lethal systems. Countermeasures consist of equipment and tactics designed to degrade enemy ADA systems. Defensive countermeasures equipment for ADA

include: electronic jammers, chaff, and flares to blind enemy ADA radars or to misguide approaching missiles. Unfortunately, countermeasures equipment is not cheap; so all aircraft are not adequately protected. One of the simplest and most effective defensive measures is to fly at low altitudes or during periods of poor visibility to reduce aircraft signature and ADA engagement times.

Offensive countermeasures consist of the series of lethal and non-lethal pre-assault fires used to destroy or negate the effectiveness of ADA systems. A support package for an airdrop could consist of "Wild Weasel" ADA suppression aircraft, fighter bombers, and AC-130 gunships. These aircraft have sophisticated systems which can effectively neutralize most ADA systems; particularly anti-arcraft artillery (AAA) or larger SAMs which are vehicle mounted, towed, or fixed in place. Shoulder fired SAMs, though, remain a difficult system to locate. Due to their small size, they can be easily hidden and thus escape the pre-assault preparation of the DZ. The existence of shoulder fired SAMs increases the likelihood of losing a transport during the airdrop.

USAF transports face many risks during an airborne operation, but they are most vulnerable during an airdrop. Although the aircraft ingress into the objective area at low altitudes, they must climb to higher altitudes for several minutes prior to and during the drop. Combat airdrop

altitudes vary from 500 feet to 1350 feet depending on whether the plane is carrying personnel or equipment. For every hundred feet of increased altitude, the corresponding increase in radar acquisition range is significant. Additionally, the aircraft usually fly in trail formation which increases their passage time over the DZ. Passage time for an airdrop of an entire DRB (Medium) can take up to twenty minutes. This prolonged exposure occurs precisely when the airborne force is most vulnerable. In order to maximize the size of the DZ, most drop zones, on airfields, are oriented along the axis of one of the runways. Consequently, it is fairly easy to predict the expected direction of an airdrop.

Losing transport aircraft during an airdrop could have significant consequences on both the outcome of the battle and on U.S. public opinion. Each transport, depending on the type of aircraft, can carry 64 to 154 parachutists or up to four pieces of equipment; such as vehicles, artillery, and materiel. Although personnel and equipment are cross-loaded to minimize the effects of losing a plane, the loss of more than a few planes could jeopardize the success of the operation. Perhaps just as importantly, would be the potential effect on the U.S. national will. Even if the airborne force was victorious, it is doubtful that the U.S. public would support the loss of so many American lives.

Future shortages of airlift may also affect airborne operations. The USAF currently plans on acquiring 120 C-17s to replace the aging fleet of 230+ C-141 aircraft. Even though the C-17 is more survivable and represents a net increase in strategic airland capability than the C-141, it represents a net decrease in airdrop capability. Although the C-17 can carry about the same number of heavy drop platforms as a C-141, it can only carry 102 parachutists; versus the 154 of a C-141. This potential loss of airdrop capability could be significant. The current Alpha Echelon (airdrop echelon) of the 82d Airborne Division DRB (Medium) requires 45 C-141 sorties.[3] In the future, it will require 48 C-17 sorties. Although three additional aircraft may not appear like a significant difference, the net effect on the force will be. The Alpha Echelon of the future DRB (Medium) will require 40% of the available C-17 fleet compared to its current requirement for 30% of the C-141 fleet. There is some doubt as to whether this many C-17s could be quickly assembled on short notice, or that a unified commander would want to apportion so much of his strategic airlift to an airdrop mission.

If the U.S. Army produced an enhanced mobility airborne force, the tactical and operational capabilities of the airborne division might be increased. Obviously, such a mobile airborne force would need to be smaller than the current DRB (Medium) in order to compensate for the

additional airlift needed to transport the extra vehicles. However, if a valid force could be developed, the pay-off might be great. Such a force would not need to jump on a defended airfield. Instead, it could drop beyond line of sight of the enemy, out of range of the ADA, and maneuver rapidly to seize the airfield. In fact, in view of enhanced airdrop resupply capabilities currently under development, the airfield might not be an objective until later in the operation. As a result, the initial assaults by the airborne force could become enemy oriented instead of terrain oriented. This would be more in keeping with the Airland Battle tenets of agility and initiative. Airborne units would have the ability to maintain surprise and the initiative.

Subordinate Research Questions

1. What would this enhanced mobility airborne force structure look like?

2. How much airlift would be needed to transport the force?

3. Would the enhanced mobility and lethality of the force compensate for the reduction in infantrymen?

4. How would the logistical requirements of the proposed force compare to those of the current DRB (Medium)?

5. What strengths and limitations does the proposed force have?

Scope

In this study, the capabilities of the current 82d Airborne Division DRB (Medium) and a proposed enhanced mobility airborne battalion task force were compared. The DRB (Medium) was the base case of the comparison. Both forces were analyzed for lethality, survivability, airlift requirements, aircraft survivability and sustainability. Furthermore, the trade-off in increased lethality and mobility versus the reduction in the number of infantrymen was examined to determine if a significant increase in U.S. airborne capabilities resulted.

Assumptions

1. The U.S. Army will continue to maintain conventional airborne forces in future force structures. The force will maintain forced entry parachute assaults as part of its Mission Essential Task List (METL).

2. The Joint Chiefs of Staff (JCS) will require the USAF to maintain a DRB airdrop capability.

3. The USAF will acquire, at a minimum, the 120 C-17s currently authorized to replace the C-141 fleet.

4. The Department of Defense (DOD) will continue to fund or will allocate funds for the modernization items identified in Appendix A; which support the concept of developing a mobile airborne force.

Limitations

All U.S. and Threat weapons capabilities were examined using official unclassified DOD estimates. Thus, all results are limited to unclassified conclusions and implications. The scenario used for the analysis was developed using unclassified materials, and consequently, does not completely reflect U.S. and Threat capabilities, procedures, and force structures. However, every attempt was made to make the scenario as realistic as possible.

Delimitations

For the purpose of this study, a motorized airborne force was used for the analysis. The HMMWV was used as the principle vehicle since it already exists and consequently the U.S. already has a limited mobile airborne capability at hand. This force delimitation facilitated the analysis since the characteristics of the HMMWV are known. Concentrating on this form of mobility also facilitated the study of the primary research question without becoming mired in questions regarding what type of mobility or which specific vehicle would perform best.

Significance of the Study

This study analyzed a possible contingency force that possessed unique capabilities. As the Army draws down from sixteen divisions, forward deployed, to a smaller Army, primarily based in the continental united States (CONUS),

the roles and capabilities of contingency forces will increase in importance. Studies, such as this one, which evaluate possible alternatives to existing forces may help the Army develop the best force for the future.

CHAPTER 2

LITERATURE REVIEW

A great deal of writing exists which provides a historical basis for this stud· As the modernization of military forces has taken place over the past few decades, the adequacy and role of the airborne forces has been questioned by many respected military analysts. Generally, all of these writers agree that the lack of mobility and lethality jeopardizes the success of future airborne operations. The vast majority of these writers envisioned a simple solution to these weaknesses such as the addition of new equipment (e.g. helicopters) to the division structure, better weapons, or refined command and control procedures. Only recently have major reorganizations of the airborne division structure, capabilities and missions been considered.

General James M. Gavin, a WWII commander of the 82d Airborne Division, published Airborne Warfare in 1947. Airborne Warfare contained a history of American airborne operations during WWII and General Gavin's vision of the future airborne force. He accurately predicted the development of long range air transports and the role of the

airborne division as national contingency force; able to quickly respond to a crisis anywhere in the world.[4]

General Gavin felt that the WWII airborne force must be improved in order to remain an effective fighting force. He believed that the greatest weaknesses of the WWII airborne force was a lack of ground mobility and effective antitank weapons.[5] He stated that the force was only as strong as its weakest component; and that if an airborne force did not have the means to fight effectively, it would quickly be defeated.[6]

However, General Gavin was optimistic on the survival of the airborne forces. He believed that the future use of airborne forces would only be limited by the imagination of the airborne commanders.[7] He was confident that once the transportation and equipment weaknesses were remedied, the Army could develop more intelligent ways to use the airborne force.[8]

During the 1960's the development of an effective assault helicopter and its successful use on a large scale brought the inevitable comparison of the capabilities of an airborne division versus an airmobile division. The advent of the helicopter, coupled with the lack of recent combat parachute assaults, brought the very existence of airborne units into question. For these reasons, as well as the U.S. involvement in Vietnam, the U.S. Army airborne forces shrunk

considerably during the 1960's. Between 1964 and 1968, the size of the Army airborne forces was reduced almost 50%.[9]

James Hessman and B.F. Schemmer in their Armed Forces Journal article entitled, "The Airborne Obsolete?" compared the capabilities of the airborne and airmobile divisions. The authors interviewed several senior Army leaders for their article. Among them, was Major General John Norton, a former commander of the 1st Cavalry Division (Airmobile) and a WWII paratrooper. Although a strong proponent of airborne forces, General Norton felt that the greatest weakness of the WWII airborne force was the lack of artillery and tactical mobility. In his opinion, if the airborne force did not land directly on the objective, it lost surprise--its greatest weapon.[9] Although recognizing the limitations of the airborne division, Hessman and Schemmer concluded that it still had redeeming value since it possessed greater strategic mobility and flexibility, and it effected a greater psychological impact on the enemy than the airmobile division.[10]

Discussion on the employment of airborne forces continued into the 1970's. In 1976, Colonel Fletcher K. Ware wrote an article for the Military Review entitled, "The Airborne Division and a Strategic Concept." Defending the existence of the airborne division against critics, Colonel Ware asserted that the airborne division's mobility, multi-capability and survivability insured its role in the

U.S. Army. Colonel Ware defined mobility as a combination of the airborne division's higher readiness level, quicker response time through strategic airlift, and its ability to project power using less airlift than other units. He defined multi-capability as the airborne division's ability to be used in a variety of missions, such as airborne, airmobile, and other special-type operations.[11] Using lessons learned from the 1973 Arab-Israeli War, Colonel Ware concluded that the advent of the man-portable antitank missile would give the infantryman an advantage over the tank.[12]

In the past five years, two notable works have focused on the potential future uses and structure of the airborne division. One of these was written by a student at the U.S. Army Command and General Staff College and the other one was written by the Airborne Airlift Action Office (AAACO) at Fort Leavenworth, KS.

The first work was presented in a thesis by Major Michael J. Kazmierski entitled, United States Power Projection in the 21st Century: The Conventional Airborne Forces Must Be Modernized To Meet The Army's Strategic Force Requirements And The Nations's Future Threats. This thesis compared the development of U.S. and Soviet airborne units and doctrine since WWII, analyzed future U.S. threats; and concluded that the U.S. conventional airborne forces must be given greater mobility, survivability, and lethality in

order to fight successfully on the future battlefields. Major Kazmierski highlighted the increasing proliferation of sophisticated ADA to third world countries as one of the greatest threats to the security of airborne forces. He concluded that the parachute assaults into Panama and Grenada could have been very costly if the enemy had been more capable with their ADA systems.[13]

In 1991, the Airborne Airlift Action Office (AAACO) of the U.S. Army Combined Arms Command developed a concept for the employment of future airborne forces titled, "Airborne 2004." This concept originated from interest generated by Major Kazmierski's thesis. The AAACO concept highlighted the need to study the airborne force structure to examine perceived shortfalls in doctrine, mobile fire support, tactical mobility, and mobile CSS capabilities. The AAACO's concern was that future U.S. airborne forces would not have the capability to defeat projected, expanding, third world threats. In the AAACO concept, future U.S. airborne forces would possess greater tactical mobility and lethality through the use of airdroppable squad vehicles, light attack vehicles, and multiple rocket launchers. This force would have the capability to airdrop either directly onto its objective or some distance away from it. The second option would be employed if the objective was heavily defended. The AAACO proposed force would rely on its mobility and firepower to seize the

objective while avoiding the ADA threat. Operationally, the AAACO envisioned the conceptual force being airdropped, up to 200 kilometers behind the enemy front line of troops (FLOT), and attacking major political, economic, or administrative centers in support of the national policy.[14]

The AAACO completed some initial phases of a study of their proposed concept to include developing a proposed force, conducting aircraft survivability using the *Military Airlift Command Trade-off Model (MACTOM)*, and determining airlift requirements using the *Automated Air Load Planning System (AALPS)*. They were about to begin the lethality and survivability analysis using a Computer Assisted Map Exercise (CAMEX) when the U.S. Army Training and Doctrine Command (TRADOC) canceled the study.[15]

Although the "Airborne 2004" study was terminated before it was completed, the AAACO did discover some interesting facts concerning aircraft survivability during an airdrop. The *MACTOM* aircraft survivability results indicated that transport aircraft would suffer a 6% attrition rate while conducting an airdrop on an airfield defended by shoulder fired SAM alone. If only one AAA weapon survived the pre-assault fires on the airfield, the attrition rate for aircraft could jump to 50%[16] Granted, a 50% attrition rate of transport aircraft would be catastrophic for an airborne force; but, even a 6% aircraft attrition rate could compel serious losses. If 6% of the

transport unit carrying a DRB (Medium) was destroyed, the airborne division could suffer up to 348 casualties.

The AAACO's proposed alternative force was a 100% mobile airborne battalion equipped with HMMWVs. The automated load planning results indicated that their proposed battalion task force organization could be airdropped using only 64 C-17s.[17] Although this would require more than 50% of the projected C-17 force, it compared favorably with the 66 C-17s that their 1994 DRB (modernized with new equipment) needed.[16] Since the AAACO's proposed doctrine was to drop outside the ADA threat, their alternative force lost no aircraft during the survivability analysis. As indicated above, the comparative lethality and survivability of the competing concepts were never derived, and thus, the effectiveness of the AAACO concept is still questionable.

In summary, the existing literature provided an excellent logical foundation for the work undertaken in this study to determine the potential effectiveness of developing an enhanced mobility airborne force in response to the increasingly stressful contingency operations envisioned in the coming years.

CHAPTER 3

RESEARCH METHODOLOGY

In order to evaluate the research question, "Would an enhanced airborne battalion be a more lethal and survivable contingency force than the current airborne DRB (Medium)?", and the subordinate research questions posed in the introduction, a combat simulation experiment was performed. This experiment consisted of evaluating the projected performance of the base case and alternative forces in a representative scenario. The following sections of this chapter detail the scenario, forces, and analytical tools used. The data collection plan, the analytical assumptions and limitations considered are also explained.

Scenario

General

For the study, a Southwest Asia scenario was used because it remains a potential trouble spot for U.S. forces, and there was a wealth of available information to construct the scenario. The recommencement of hostilities between a U.S. led coalition and Iraq, over issues remaining unsettled from the first Gulf War, provides the background for the development of the scenario. In an effort to divert

attention from the Allied main attack, U.S Central Command (CENTCOM) conducts an airborne assault to seize an airfield in Iraq. The mission of the airborne force is to establish an airhead, accept airland reinforcements, and await link-up with U.S. ground forces.

Terrain

The terrain, used in the scenario, consisted of generally flat arid desert. The ground contained numerous hill masses, trafficable by all types of vehicles, and which afforded both sides with cover. Ridgelines, along each hill, blocked all line of sight; except to units less than 200 meters from the ridgeline. These units were considered "hull down" when being engaged by enemy units from the far side of the ridgeline. The remaining ground was considered flat and provided no cover or concealment to ground forces. Although, this interpretation of desert terrain is slightly unrealistic, it simplified engagement simulation by reducing unconscious bias when evaluating line of sight engagement criteria.

Scenario Details

Start Time: 2300
P-Hour: 2305
Before Morning Nautical Twilight (BMNT): 0500
End of Evening Nautical Twilight (EENT): 1900
Visibility: Unlimited
Ceiling: Clear

Forces

Red Forces

Organization of the Red Forces

The Red forces are organized using a modified version of the Iraqi forces listed in CGSC Student Text 101-8, "Southwest Asia Staff Planning Book." Figures 1 and 2 contain detailed organizational diagrams. The Red forces consist of two units: an Iraqi commando company reinforced with ADA assets and a BTR-60P platoon, and a mechanized battalion task force. The reinforced commando company is defending the airfield, and the mechanized task force is occupying an assembly area 22 kilometers away. Listed below are the major items of equipment.

Airfield Defense Unit[19]

Unit	Equipment Type	Quantity
commando company	personnel	121
	60mm mortar	3
	SPG-9	4
ADA battery	S-60	2
	ZSU 23-4	2
	SA-14	4

Mechanized Battalion Task Force[20]

Unit	Equipment Type	Quantity
tank company	T-72	11
3 x mechanized companies	BMP	39
reconnaissance platoon	BRDM	6
anti-tank platoon	BRDM	6
artillery battalion	2S1(152mm, SP)	18
mortar battery	120mm mortar	12
ADA platoon	SA-14	8
ADA platoon	ZSU 23-4	2

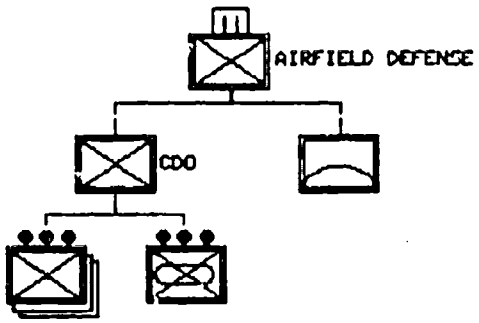


Figure 1. Task Organization of the Airfield Defense Unit

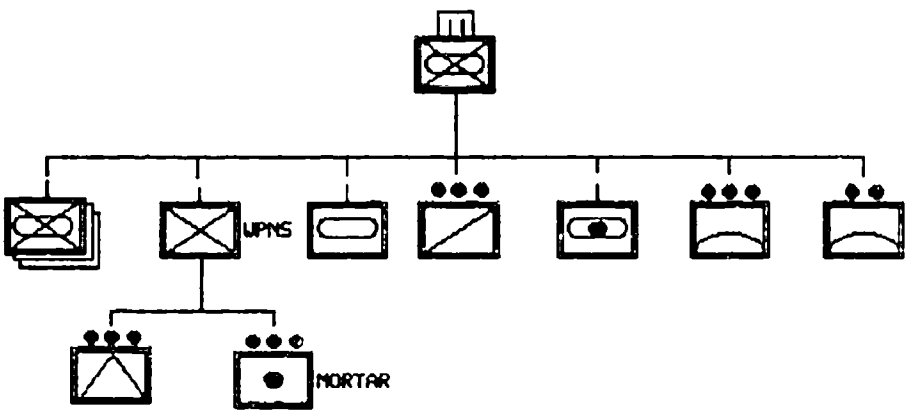


Figure 2. Task Organization of the Mechanized Battalion TF

Mission of Red Forces

The mission of the Red forces, at the airfield, is to deny its seizure by Allied forces. If an attack is successful and the Allies gain control of the airfield, the mission of the mechanized task force is, within two hours of notification, attack to defeat the Allied forces and recapture the airfield.

Blue Forces

Two separate Blue forces, the current DRB and the EMAB, were evaluated using the same scenario. Although each force had the same mission, their organization and method of employment differed.

Blue Force Mission Statement

On P-hour, D-Day, Blue forces seize Aljamam Airfield in order to secure a lodgement for follow-on forces; on order, expands airhead to prevent enemy interdiction of the airfield.

Organization of Current DRB (Medium)[21]

The current DRB (Medium) is task organized into an assault echelon (A-echelon) deployed by parachute assault and an airland follow-on echelon (B-echelon). Figure 3 contains a complete organizational diagram of the DRB (Medium). It is important to note that this generic force package contains only a fraction of the DRB's total equipment.

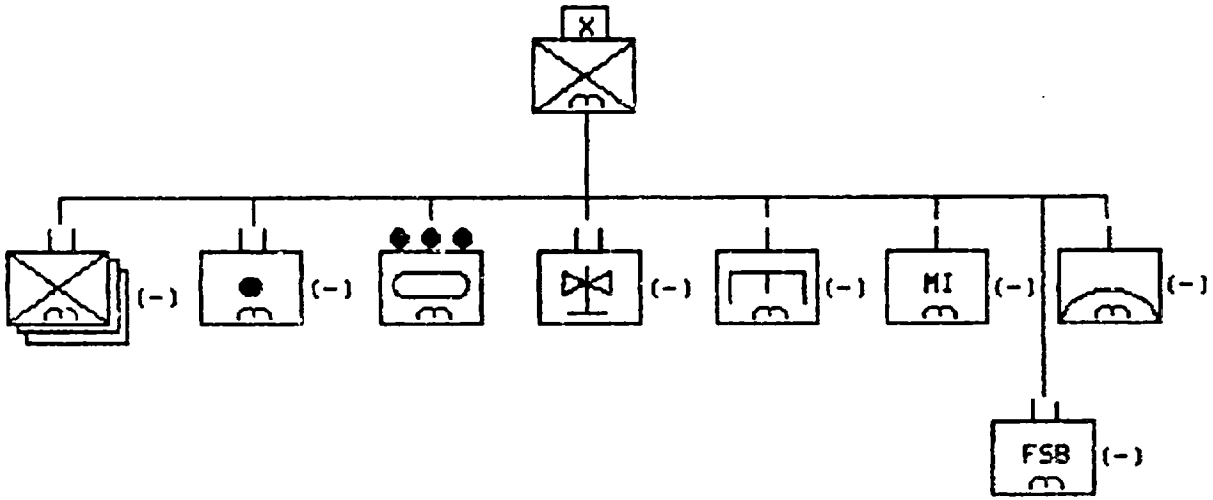


Figure 3. DRB (Medium) Task Organization

Listed below are the major units and equipment contained in a DRB (Medium).

Unit	Equipment Type	A-echelon	B-echelon
3 x airborne bns	personnel	2195	496
	HMMWV (TOW)	12	2
	Dragon	54	0
	81mm mortar	12	0
	60mm mortar	18	0
artillery battalion	105mm howitzer	12	6
armor platoon	AGS	4	0
ADA platoon	Stinger	20	0
ADA platoon	Vulcan	0	3
engineer company	D5 bulldozer	1	0
	Grader	1	0
	Scoop loader	1	0
	13 whl roller	1	0
	2 1/2T DmpTrk	0	1
	5T Dump Trk	0	1
air cavalry troop	AH-58D	0	6
	UH-60	0	2
assault helicopter co.	UH-60	0	6
	OH-58	0	1

Scenario Description

The DRB (Medium) scenario consisted of a two phase operation. Phase I was the seizure of a lightly defended airfield in order to secure a lodgement (airhead) for the arrival of follow-on airlanded forces. Phase II was the defense of the airhead. During Phase I (Airfield Seizure), the DRB (Medium) seized a large international airport defended by S-60 (57mm AAA), SA-14 (SAM), a Red infantry company, and a platoon of BTR-60 personnel carriers. Red units defended the airfield by positioning ADA systems separated 2-4 km from the runway and each other, in order to maximize their engagement coverage and to provide mutually supporting fires. In order to compensate for the notional

pre-assault fires, it was assumed that the U.S. aircraft destroyed all of the AAA and all but two SA-14 teams. Each SA-14 team was equipped with four missiles each. Although the drop occurred at night, sufficient ambient light existed which permitted the surviving enemy to visually acquire and engage the transports with their SAMs.

The Red infantry defended the airfield with three platoons occupying squad size strongpoints located around the airfield. Figures 4 and 5 contain the Phase I concept of operations diagram and the initial situation map. The airfield reserve consisted of the platoon of four BTR-60 personnel carriers. The reserve was located at grid 558631 and began counterattacking 20 minutes after the alert. Alert occurred with initiation of the airdrop.

Following the end of the airdrop, the DRB (Medium) took thirty minutes to assemble into effective fighting units. After assembling, the Blue forces immediately assaulted enemy defensive positions. Red units defended until they were completely destroyed. Once, all enemy units at the airfield were destroyed, the B-echelon airlanded and the Blue forces moved out to establish the airhead and prepare for the attack by the Red mechanized battalion task force.

During Phase II, the Red mechanized/tank force attacked to destroy the U.S. airhead. Blue forces positioned their infantry to provide 360 degree protection

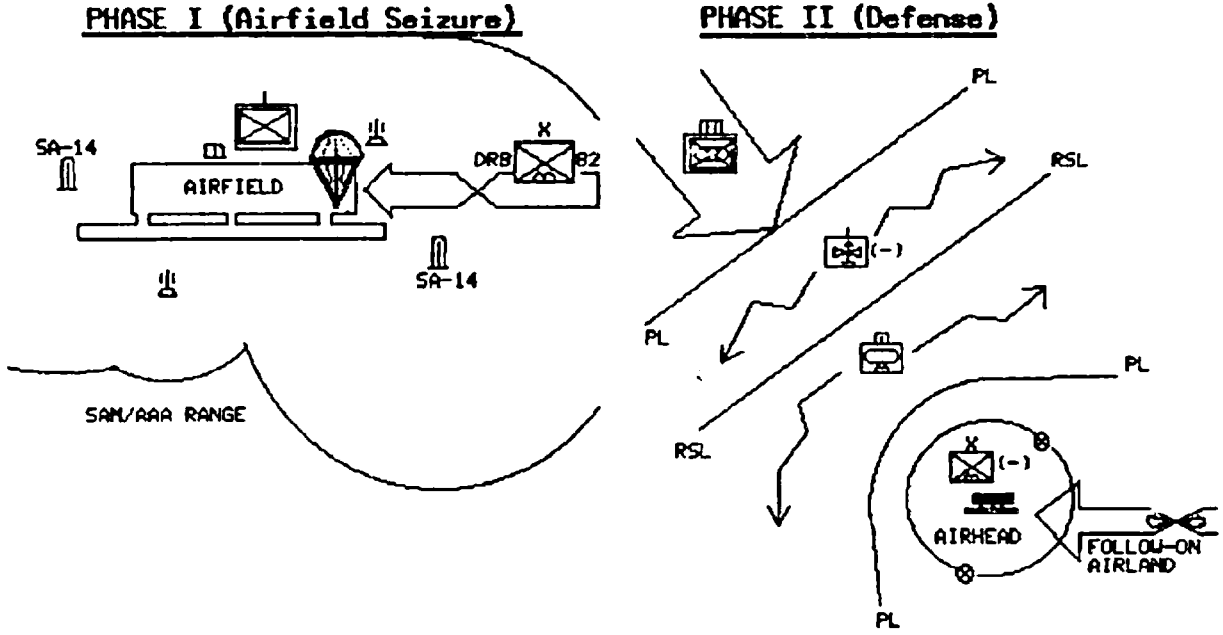


Figure 4. DRB (Medium) Phases I/II Concepts of Operations

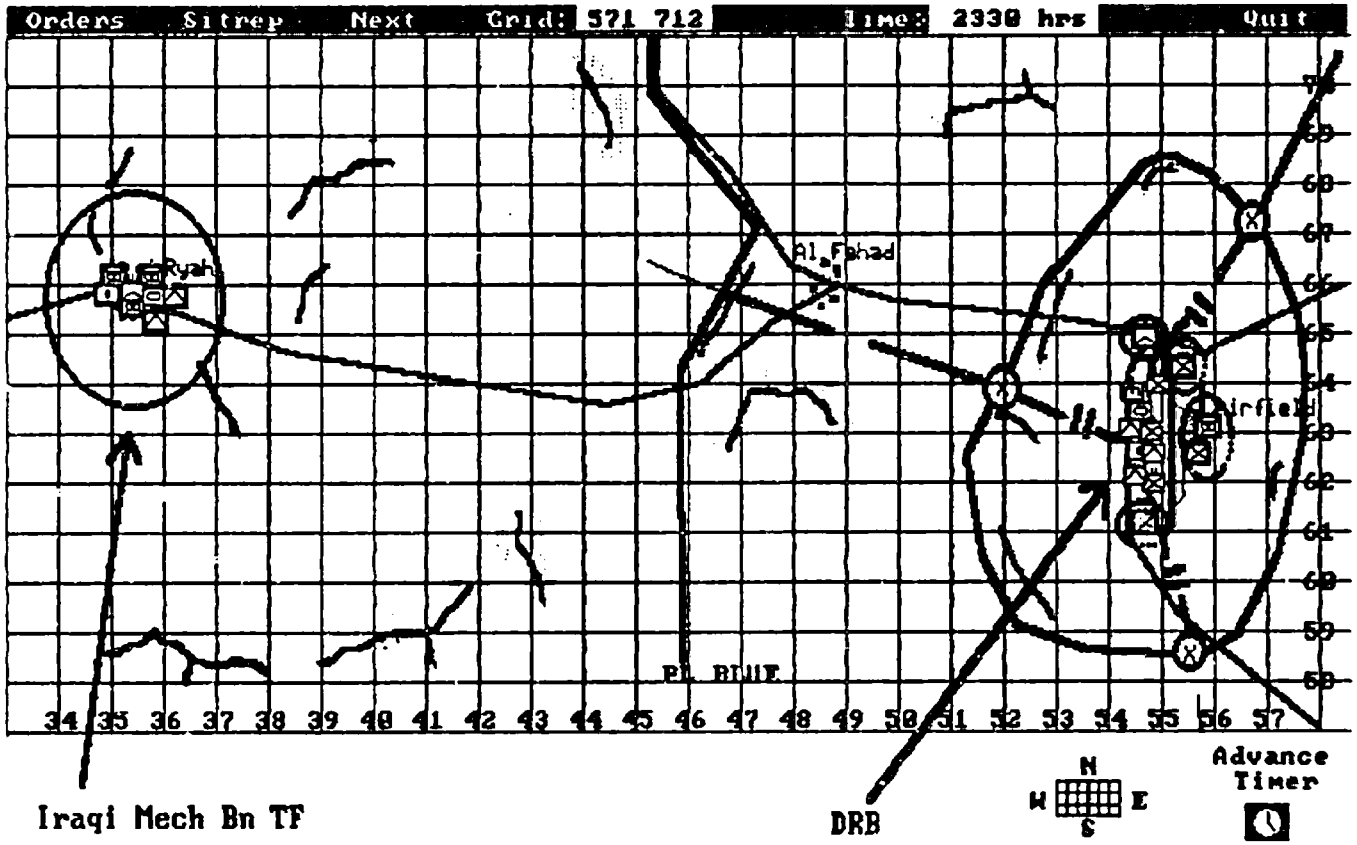


Figure 5. DRB (Medium) Phase I Situation Map

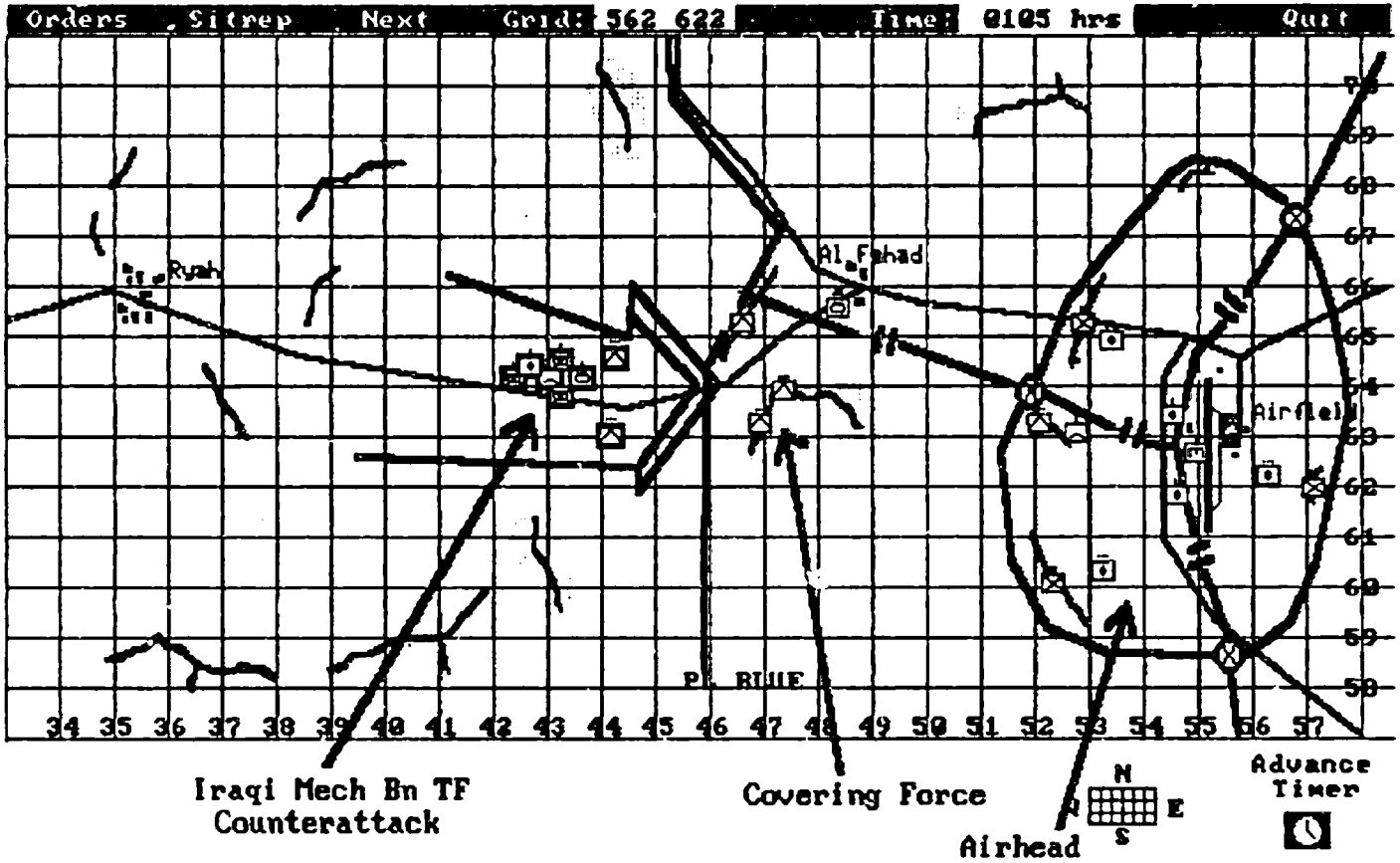


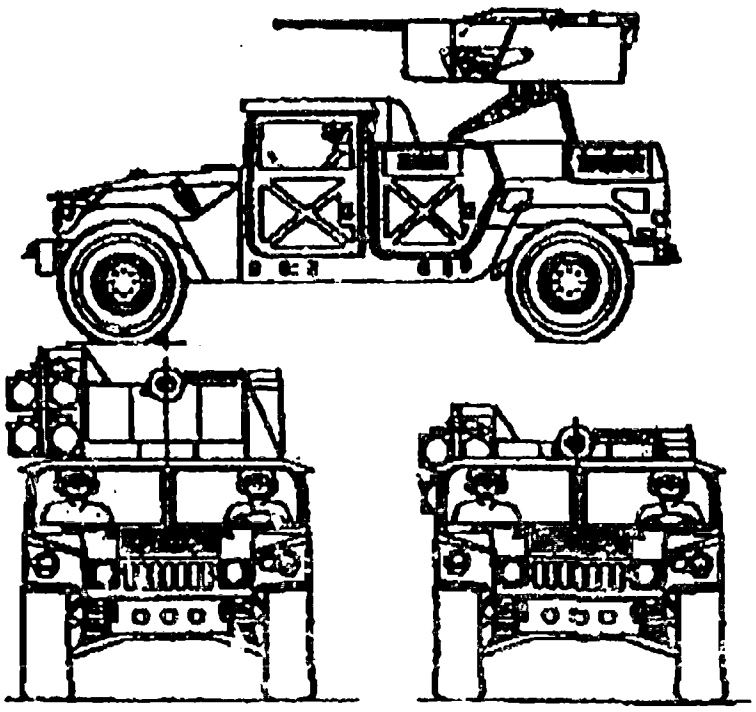
Figure 6. DRB (Medium) Phase II Situation Map

to the airhead. The bulk of the armor and TOW vehicles were positioned to cover the high speed avenue of approach from the West. All artillery and combat support units occupied positions within the airhead. Figures 4 and 6 contain the Phase II concept of operations diagram and the situation map. All units fought until they were destroyed, ran out of ammunition, or lacked any offensive capability. Only wire guided missile systems were resupplied. All other units fought until their basic load was exhausted.

Organization of Proposed EMAB

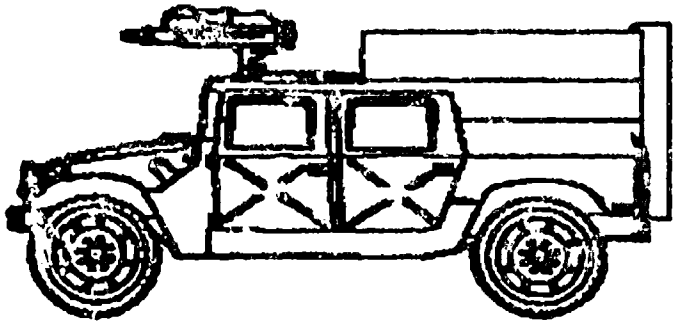
The proposed Enhanced Mobility Airborne Battalion is 100% mobile, and with the exception of the helicopters, is 100% airdroppable. It utilizes the HMMWV squad carrier as its principle personnel carrier. This vehicle mounts a MK-19 grenade launcher and provides limited armored protection against small arms fire. It can carry a nine man infantry squad, plus associated equipment, or a mortar squad with equipment.[22]

The LCAS was used as a replacement for the HMMWV (TOW). It mounts a 25mm chain gun and a TOW missile launcher with four missiles. The chain gun provides additional fire power; particularly against infantry and light skinned vehicles. Both vehicles were used since they already exist (although in prototype form only). See Figure 7 for illustrations of these vehicles and Figure 8 for a detailed organizational diagram of the EMAB.[23]



Light Combat Assault Vehicle (LCAS)

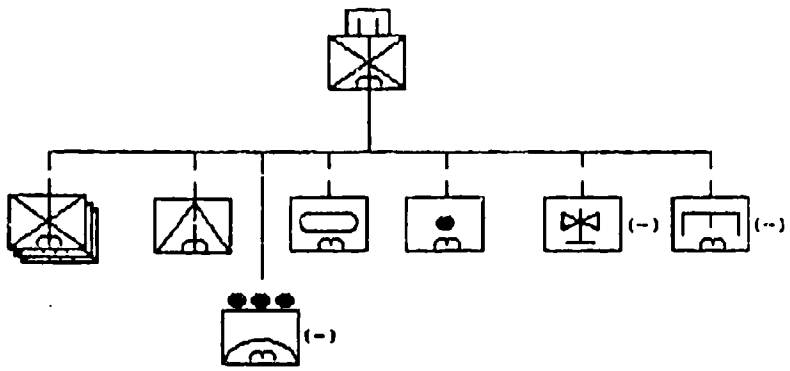
4 x TOW
1 X 25mm Chain Gun



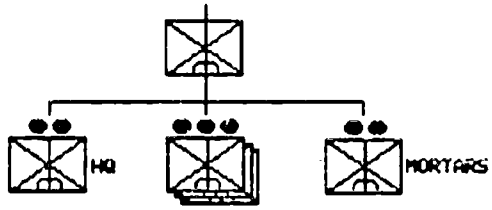
HMMWV Squad Carrier

1 X Mk-19 Grenade Launcher
9 X Troops

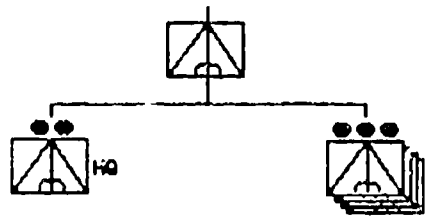
Figure 7. EMAB LCAS and Squad Carrier[24]



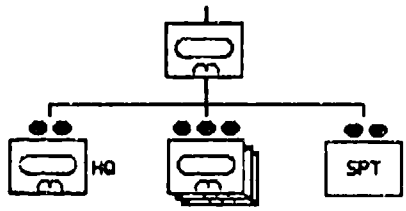
Enhanced Mobility Airborne Battalion (EMAB)



Enhanced Mobility Airborne Company



Light Combat Assault Company



Light Armor Company

Figure 8. EMAB Task Organization

Unit	Equipment Type	A-echelon	B-echelon
1 x motorized abn bn	personnel	800	100
	LCAS	20	0
	Sqd Carrier	36	0
	Dragon	18	0
	81mm mortar	4	0
	60mm mortar	6	0
artillery battery	155mm Howitzer	8	0
armored company	AGS	14	0
ADA platoon	Stinger	20	0
ADA platoon	Avenger PMS	3	0
engineer company	D5 bulldozer	1	0
	Grader	1	0
	Scoop loader	1	0
	13 whl roller	1	0
	2 1/2T Dmp Trk	1	0
	5T Dmp Trk	1	0
air cavalry troop	AH-58D	0	6
	UH-60	0	2
assault helicopter co.	UH-60	0	6
	OH-58	0	1

Scenario Description

The scenario for the enhanced mobility airborne force was very similar to the base case scenario. It too was a two phase operation. The chief difference was that during Phase I (Airfield Seizure), the enhanced mobility airborne force landed to the south of the airfield out of ADA range. Following assembly, the enhanced mobility airborne force attacked using fire and maneuver to seize the airfield. See Figures 9 and 10 for the Phase I concept of operations diagram and the initial situation map.

During Phase II, the enhanced mobility airborne force defended the airhead from positions forward of the airhead line. This permitted the force to conduct an enemy

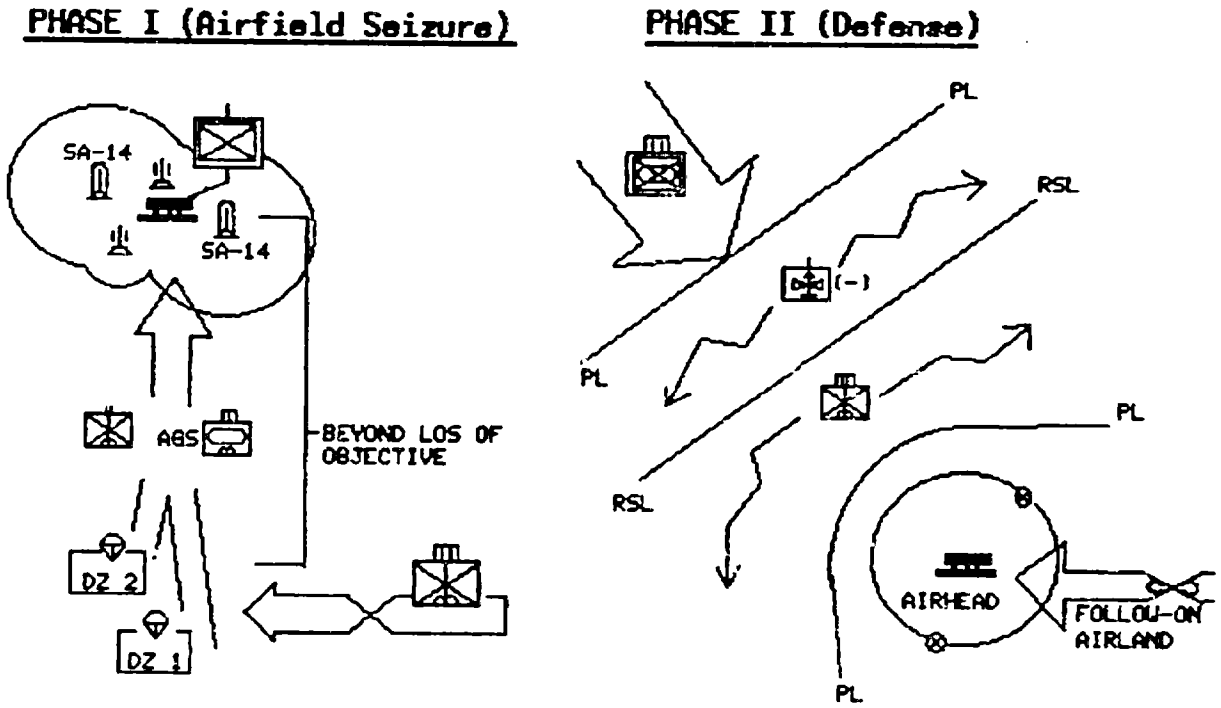


Figure 9. EMAB Phase I/II Concepts of Operations

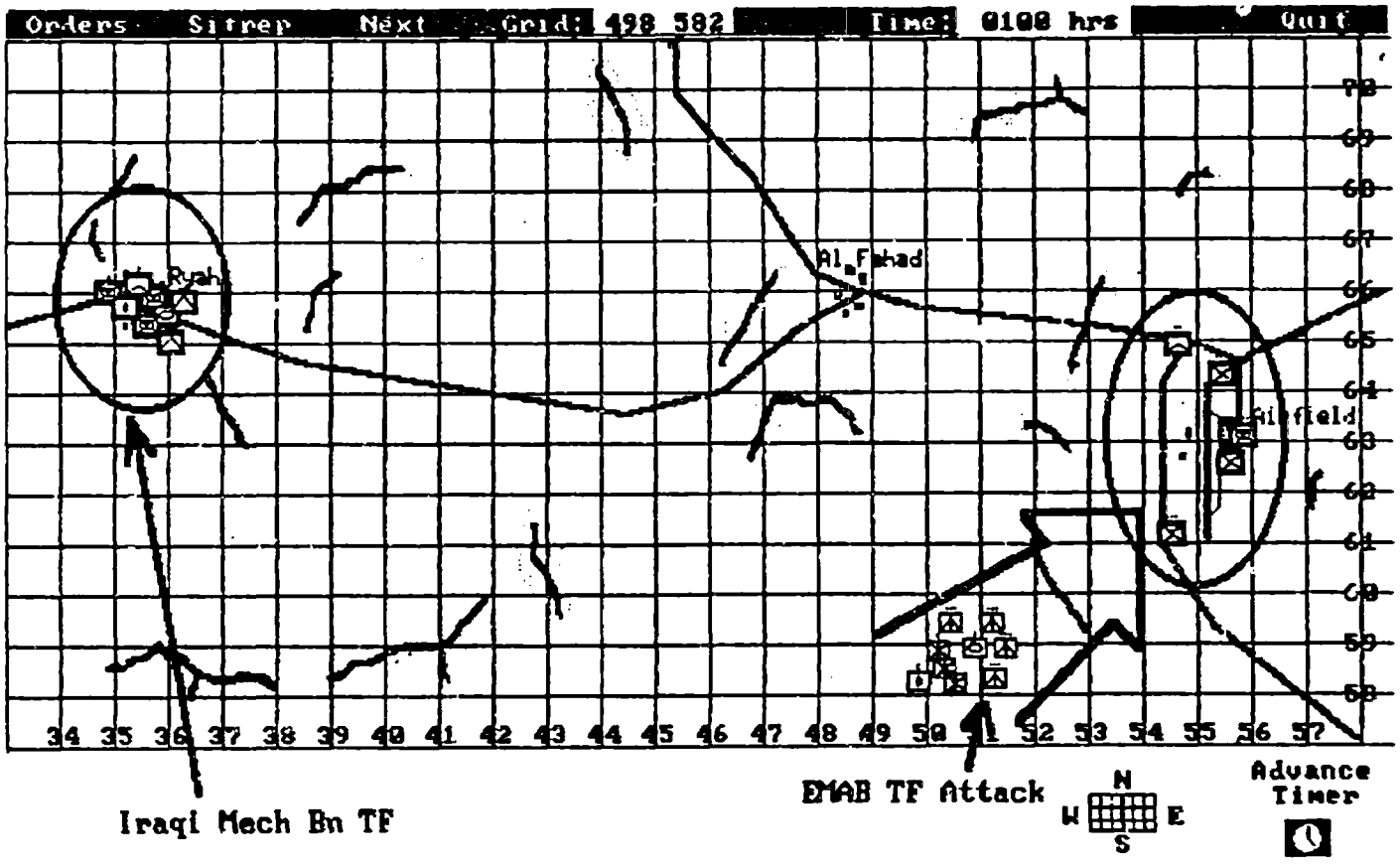


Figure 10. EMAB Phase I Situation Map

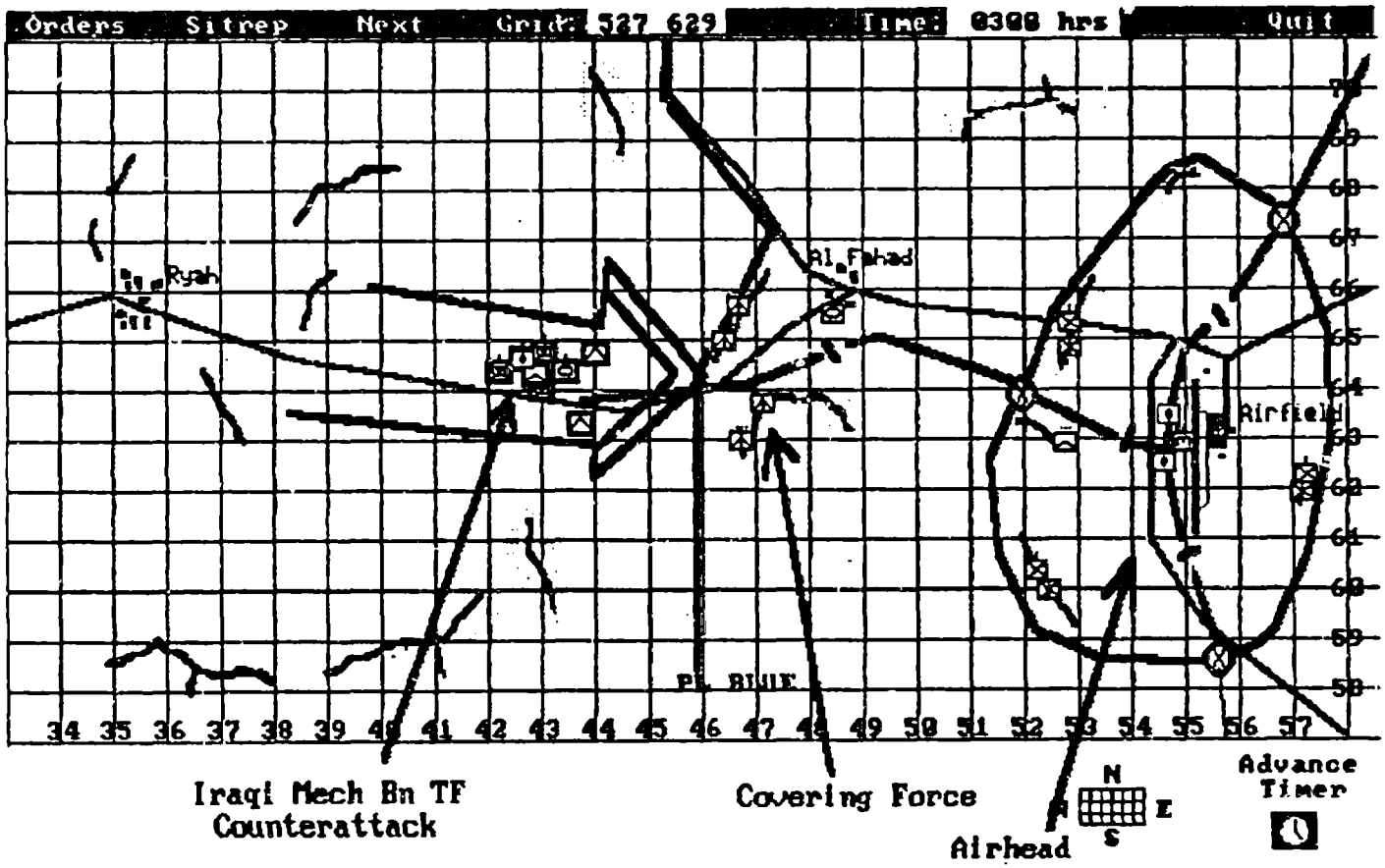


Figure 11. EMAB Phase II Situation Map

oriented defense. See Figures 9 and 11 for the Phase II concept of the operations diagram and the situation map.

Analytical Tools

In order to evaluate both alternative forces in the areas of concern (i.e. airlift requirements, aircraft suvivability, lethality, survivability, and sustainability), the following analytical tools were used: The *Airborne Wargamer*, the *Automated Air Load Planning System (AALPS)* and FM 101-10-1/2, *Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2)*.

AALPS

AALPS is a UNIX based computer planning tool that the U.S Army uses to conduct air movement planning. It provides an automated capability to determine the number of sorties that a unit needs for strategic/tactical airland or airdrop missions. It plans movement using C-130, C-141, C-5, and C-17 aircraft. The program provides a hard copy printout of the total number of required aircraft and a valid load plan of each aircraft. It uses actual source data. The chief limitation of the program is the requirement to use a surrogate system when trying to load plan equipment which has not been fielded. For example, the HMMWV was used as the surrogate for the LCAS and the squad

carrier since they all have similar physical characteristics.[25] See Appendix B for a complete equipment list.

Airborne Wargamer

The *Airborne Wargamer* is an IBM compatible computer game designed to provide brigade/battalion commanders and staffs with a realistic tool for conducting command post exercises (CPX) or evaluating tactical courses of actions. It is a stochastic system generating random numbers applied against established probabilities of hits and kills to determine combat results. Thus, it reflects the element of chance inherent in combat, and produces variable results. The *Airborne Wargamer* considers the effects of wind speed, visibility, and ceiling when calculating combat results. It is the only tool for predicting jump related casualties and is the only simulation which can model an airborne operation from start to finish.[26]

The *Airborne Wargamer* contains a data base for simulating a number of various unit types and weapon systems. It also contains a map building program for constructing 1:50,000 maps. Its algorithms were constructed using unclassified information gained from field manuals (FM), technical manuals (TM), National Training Center (NTC) artillery casualty tables, and other military conflict simulations. The Airborne Wargamer User's Manual contains a detailed description of every algorithm used in the

simulation. The *Airborne Wargamer* was designed as a separate project unrelated to this thesis.

The chief limitations of the *Airborne Wargamer* are its limited weapons database and its lack of a hard copy printout option. In order to compensate for these limitations, a hard copy print out feature was added to the program in order to simplify records keeping. Several weapons systems were added to the database to incorporate the proposed weapons systems (eg: LCAS). This program was used because it was deemed the best available tool for evaluating lethality and survivability. Other simulations, such as *ARTBASS* and *JANUS*, were not available.

FM 101-10-1/2 (Volume 2)

FM 101-10-1/2, "Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2)", is a U.S. Army staff officers' planning guide for calculating logistical estimates of various items of supply and services. This FM, based on historical data, contains usage tables for all types of supplies and services. Logistics planners use it to estimate consumption rates, materiel requirements, and perform transportation calculations. Bulk fuel requirements for a unit can be determined by multiplying the quantity of type vehicles by a planning factor specific to a geographical area and utilization rate. Ammunition requirements can be determined

by cross-indexing an ammunition type with the planned combat mission. Both requirements can be calculated in short tons (STONS).

Data Collection Plan

Definitions of Measure

Airlift requirements. The maximum number of C-17 aircraft needed to transport an entire force into the objective area. *AALPS* was used to produce this data.

Lethality. Blue force weapons systems were analyzed for both lethality against personnel and lethality against equipment. Lethality was defined as follows:

$$\text{Lethality} = \frac{\text{\% Red Losses}}{\text{Time}}$$

The resulting force lethality number represents the percentage of Red personnel or equipment destroyed as a function of time. It is indicative of the relative lethality of the Blue forces. The *Airborne Wargamer* was used to collect lethality data. Each alternative force was evaluated using fifteen repetitions of the scenario.

Survivability. Force survivability was measured by the formula listed below. The results were obtained using the same data obtained for lethality.

$$\text{Force Survivability} = \frac{\text{\% Blue Losses}}{\text{Time}}$$

The resulting force survivability number represents the percentage of Blue losses, both equipment and personnel, as a function of time. It is indicative of how lethal the Red fires were against the two alternatives.

Aircraft Survivability. Aircraft survivability was measured by determining the average number of aircraft lost during thirty repetitions of the *Airborne Wargamer*. These thirty repetitions were conducted independent of the fifteen repetitions done for force lethality and survivability.

Sustainability. Sustainability was measured by determining the number of short tons (STONS) of bulk fuel and major weapon systems ammunition needed by each alternative Blue force to perform its mission. This data was calculated by using FM 101-10-1/2, "Staff Officer's Field Manual, Organizational, Technical,and Logistical Data Planning Factors (Volume 2)". Other supply requirements such as food, water, barrier materials, spare parts, and prepackaged petroleum products were not considered.

Data Analysis Plan

Lethality, force survivability, and aircraft survivability data were analyzed by finding the mean, range, and standard deviation of multiple *Airborne Wargamer* repetitions. The complete set of lethality data, the mean, the range, and the standard deviation are presented in tabular form in Appendix B. All results were plotted on charts contained in Chapter 4.

The remaining two criteria, sustainability, and aircraft sorties, were determined by using tools that produced expected values, and hence result in single point estimates. The data for these criteria are reported and compared in bar graphs in the results chapter.

Assumptions and Limitations

The following assumptions were made concerning the data collection methodology:

1. The *Airborne Wargamer* is a reasonably valid simulation of combat.

2. Unclassified weapons data, used in the lethality modeling, was accurate enough to the actual classified weapons data to support the conclusions which were drawn from the data analysis.

3. The surrogate vehicles which were selected to represent the prototype vehicles (i.e., AGS, LCAS, etc.) for the *AALPS* computations are close enough in dimensions and weight as to provide valid estimates of required aircraft sorties.

4. Red units and Blue units were modeled as well trained and disciplined. They fought until they were out of ammunition, were destroyed, or were unable to conduct combat operations.

5. In order to accurately assess the relative lethalities of the two forces, helicopters were not used in the lethality analysis. Attack helicopters are extremely

lethal to armored units. Since both forces had the same helicopter types and quantities, excluding them from the simulation permitted greater opportunities for ground combat.

6. A factor potentially limiting the usefulness of this study was reliance on a single scenario. Evaluating the two cases using more and varied scenarios would produce greater confidence in the conclusions derived.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter describes and discusses the results obtained using the various models for the research of the problem, and analyzes the significance of these results as they pertain to the basic research question.

The evaluation of the enhanced mobility airborne force airlift requirements was the first step needed in the data collection process. Since limited strategic airdrop transport is anticipated, it was critical that the proposed force be measured initially for deployability to insure that its required amount of airlift would not be prohibitive. Until this fact could be ascertained, it was not prudent to conduct the remainder of the analyses. If the airlift requirements were too large, then the enhanced mobility airborne force structure would have required a reduction to make it more deployable before all other analyses could proceed.

AALPS Results

Fortunately, the initial proposed EMAB required about the same number of aircraft as the DRB. According to the *AALPS* model, the Enhanced Mobility Airborne Battalion

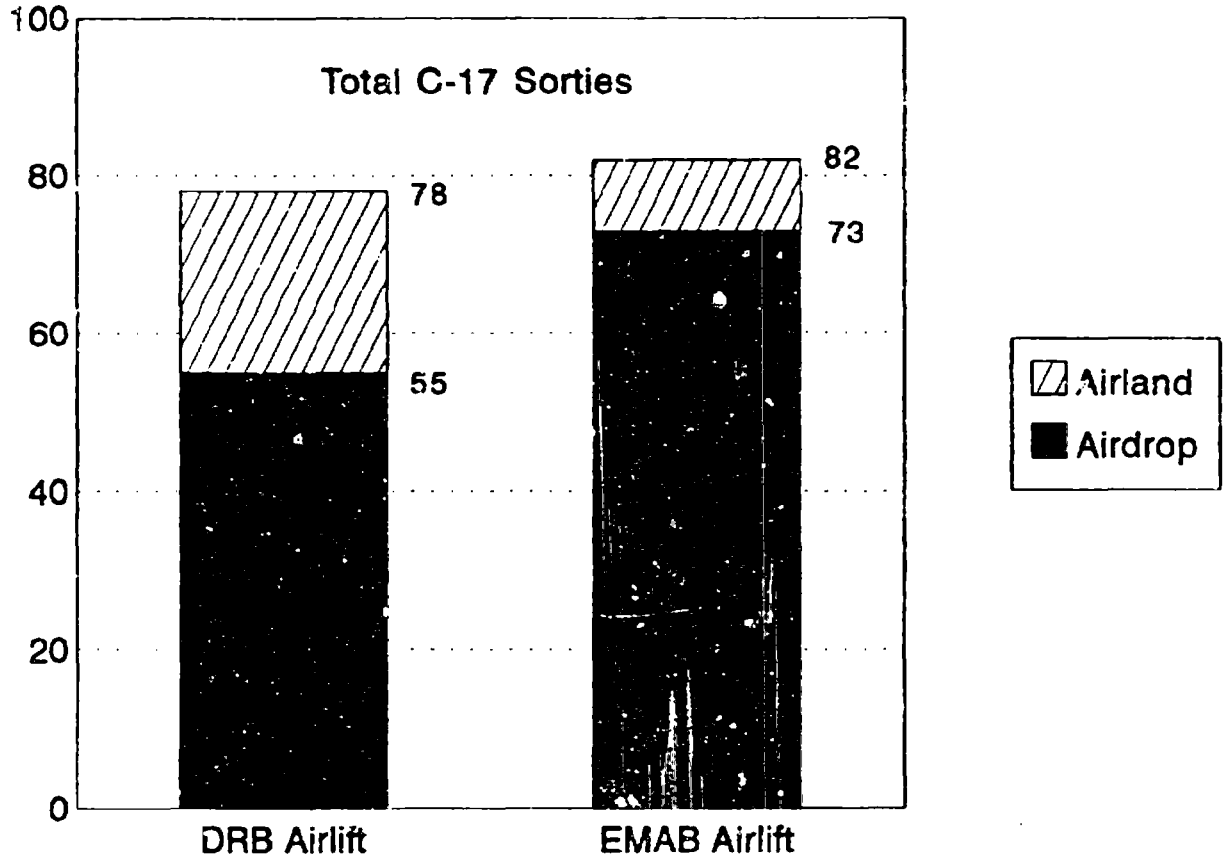


Figure 12. Airlift Requirements Results

requires eighty-two C-17s to transport it. Figure 12 contains a chart displaying the AALPS results. Seventy-three of these aircraft were configured for airdrop; while nine were needed to airland the helicopters and aviation support equipment. The current DRB (Medium) requires seventy-eight C-17s; fifty-five C-17s to airdrop the A-echelon and twenty-three aircraft to airland the B-echelon. These DRB (Medium) airlift results differ from those AAACO obtained (cited in Chapter 2), but AAACO assumed that the helicopters would self-deploy into theater for their proposed force and used a DRB (Medium) modernized with anticipated future systems. Appendix B contains the equipment load list used for each alternative. These load lists contain a complete inventory of all of the equipment and personnel which AALPS assembled into type load plans.

These findings are significant because they show that both force structures require approximately the same number of aircraft for deployment. Consequently, lethality, survivability, and sustainment of the two forces can be evaluated without considering airlift as a variable in the subsequent results and analyses.

Aircraft Survivability Results

The aircraft survivability results, provided by the *Airborne Wargamer*, indicate that the USAF could expect to suffer significant numbers of C-17 losses while conducting an airdrop mission in a relatively low threat ADA

environment. Figure 13 displays the results of the aircraft survivability analysis. During thirty runs of the Airborne Wargamer, the C-17 wing, carrying the DRB (Medium), lost an average of 3.6 aircraft, out of fifty-five (7% loss rate), while conducting a night airdrop against an enemy armed with shoulder fired SAM. The individual results of the thirty repetitions ranged from one aircraft to seven shot down. The enemy could fire only eight SA-14 missile during each run because of ammunition restrictions. This resulted in the SA-14 having an average probability of kill equal to .5 against the C-17. The standard deviation of the thirty replications was 1.76 aircraft. This translates to a 95% confidence interval, for the mean, from 2.97 to 4.17 aircraft. This means that we can say, with a very high degree of confidence, that the DRB could expect, on an average, to lose somewhere between three to four C-17s when flown in a similar scenario. These results were similar, in nature, to the *MACTOM* results listed in the Airborne 2004 study which indicated a 6% lost rate for C-17s when flown in a fairly similar scenario.[27] Appendix B contains the tabulated air survivability data.

The loss of four C-17s, during an actual operation, would equate to the loss of 408 personnel, up to twelve pieces of equipment or a combination of both. It is important to remember that the Red force was limited to

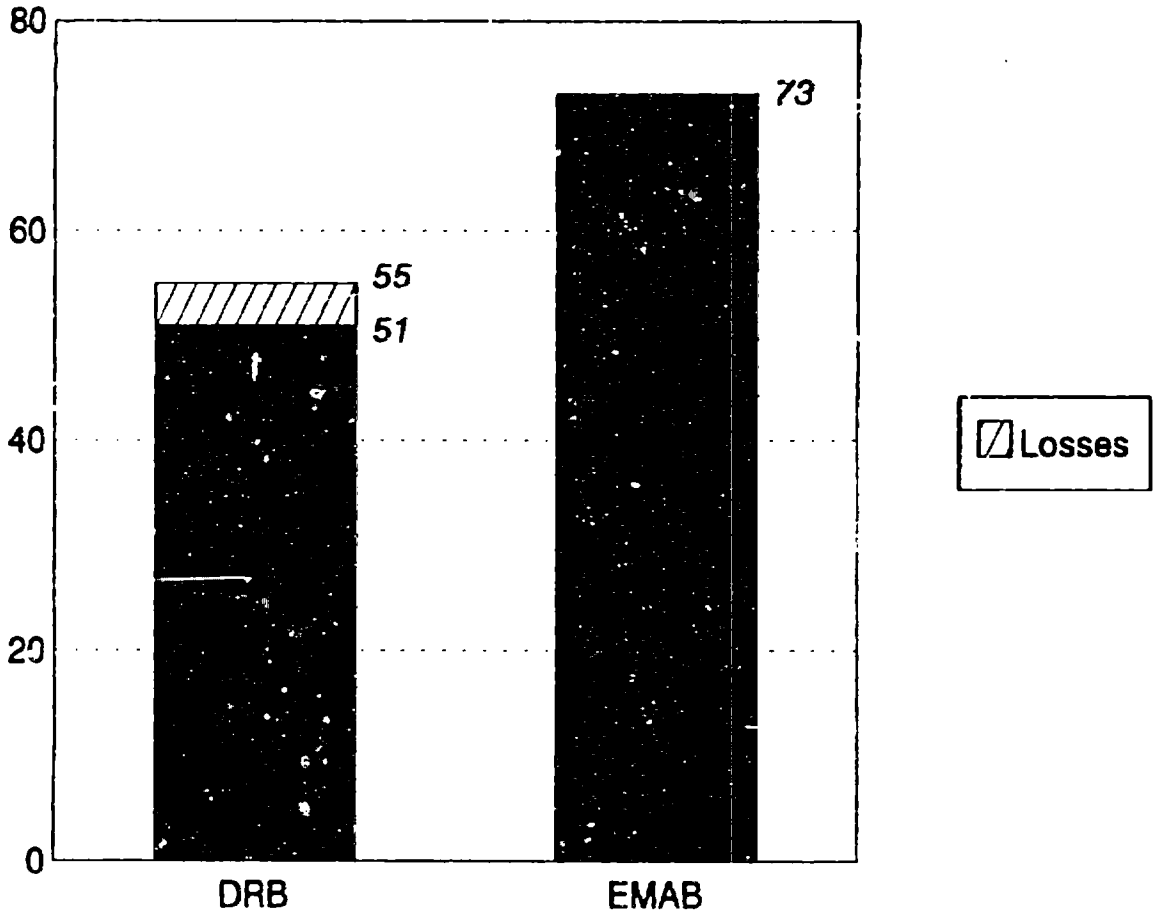


Figure 13. Aircraft Survivability Results

firing only eight SA-14 missiles. The DRB (Medium) could have lost more aircraft had there been a greater supply of missiles or had there been more ADA systems.

The USAF C-17 wing, carrying the Enhanced Mobility Airborne Battalion, conducted the airdrop beyond ADA engagement range--30 kilomters from the airfield. In accordance with the proposed doctrine, it was assumed that the EMAB lost no aircraft. Although the EMAB suffered no casualties, it was forced to conduct a two hour ground movement to the objective. This time penalty was subsequently incorporated into the computer modeling of the lethality and survivability.

Force Lethality Results

In order to better evaluate the two dissimilar alternatives, two modifications were made to the scenario. First, the DRB (Medium) was evaluated as if it had lost no personnel or equipment during the airdrop operation. This precluded the results of the aircraft survivability from skewing the force lethality and survivability results; and thus contributes to a more objective analysis. However, if they had been used, the personnel and equipment attrition suffered from the aircraft losses could have resulted in significant reductions in DRB (Medium) capabilities.

Secondly, armed scout helicopters (AH-58D) were not used during the lethality and survivability analyses. Helicopters were omitted because of their exceptionally high

lethality rates. During the initial trial testing of both forces, the AH-58Ds were so highly lethal that they usually destroyed the Red forces before the enemy could engage the Blue ground forces. Had the helicopters been included, their large contribution to the force lethality would have made the relatively smaller ground force lethalities difficult to compare. Since both forces had identical aviation forces, and the focus of the evaluation was the comparison of two dissimilar ground force structures, it was both desirable and consistent to eliminate them from this part of the study. It is important to note though, that the lethality and survivabilities of both force alternatives would have been far greater had they been able to employ their helicopters.

The two forces differed in their lethality capabilities. Figures 14 to 17 contain charts which summarize the percentage of Red forces, for both personnel and equipment, which were killed by Blue weapon systems as a function of time. The lethality line of each graph was drawn using the mean of the series of lethality data points, for each subsequent fifteen minute period, throughout the scenario portrayed. From these charts, the average length of the battles (airfield seizure and anti-armor defense), the overall endgame lethality, and the average lethality rate can be calculated for each of the alternatives. The lethality rates can be assessed by comparing the slopes of

the average lethality results (%Red casualties / min); the steeper the slope--the greater the lethality rate.

As could be expected, the infantry heavy DRB proved to be more lethal than the enhanced mobility airborne force when used against an enemy comprised predominately of infantry. Vice versa, the Enhanced Mobility Airborne Battalion fared significantly better when encountering an enemy mechanized/armored force. The endgame lethality averages for the DRB (Medium) were: enemy personnel casualties: 80% and enemy vehicle kills: 57%. The corresponding averages for the Enhanced Mobility Airborne Battalion were: enemy personnel casualties: 88% and enemy vehicle kills: 85%. Although the EMAB personnel lethality is greater than the DRB personnel lethality, the numbers, alone, are misleading. The EMAB inflicted the vast majority of the Red personnel casualties by destroying the enemy personnel carriers while they were still loaded with enemy personnel.

Division Ready Brigade (Medium)

Since it had an overwhelming numerical superiority of infantrymen, and it dropped directly onto its objective, the DRB (Medium) performed well against the enemy company defending the airfield. It took the DRB (Medium) only 45 minutes to complete its Phase I mission. By airdropping directly onto the airfield, the force massed quickly and achieved an overwhelming nine to one ratio against the

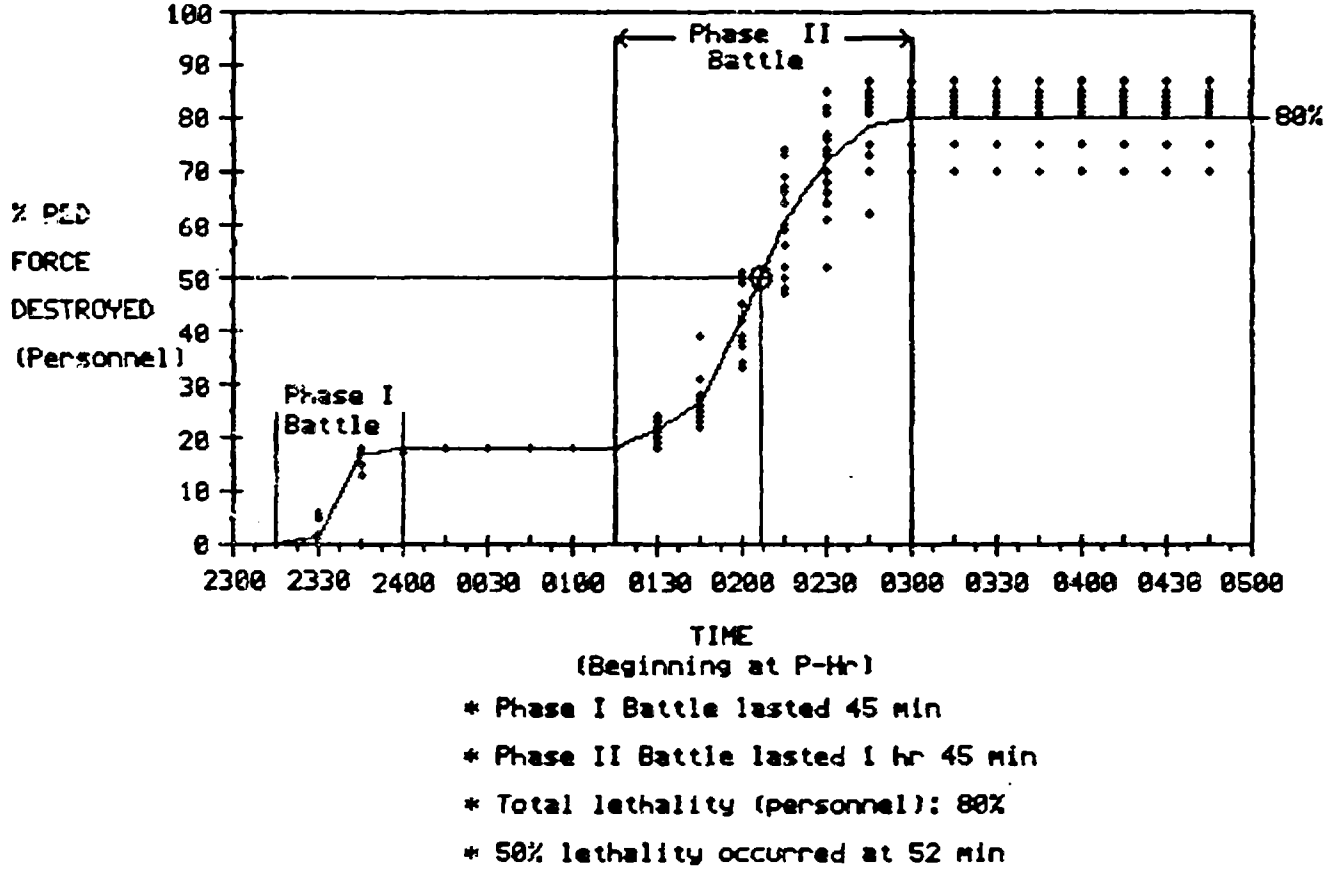


Figure 14. DRB (Medium) Personnel Lethality Results

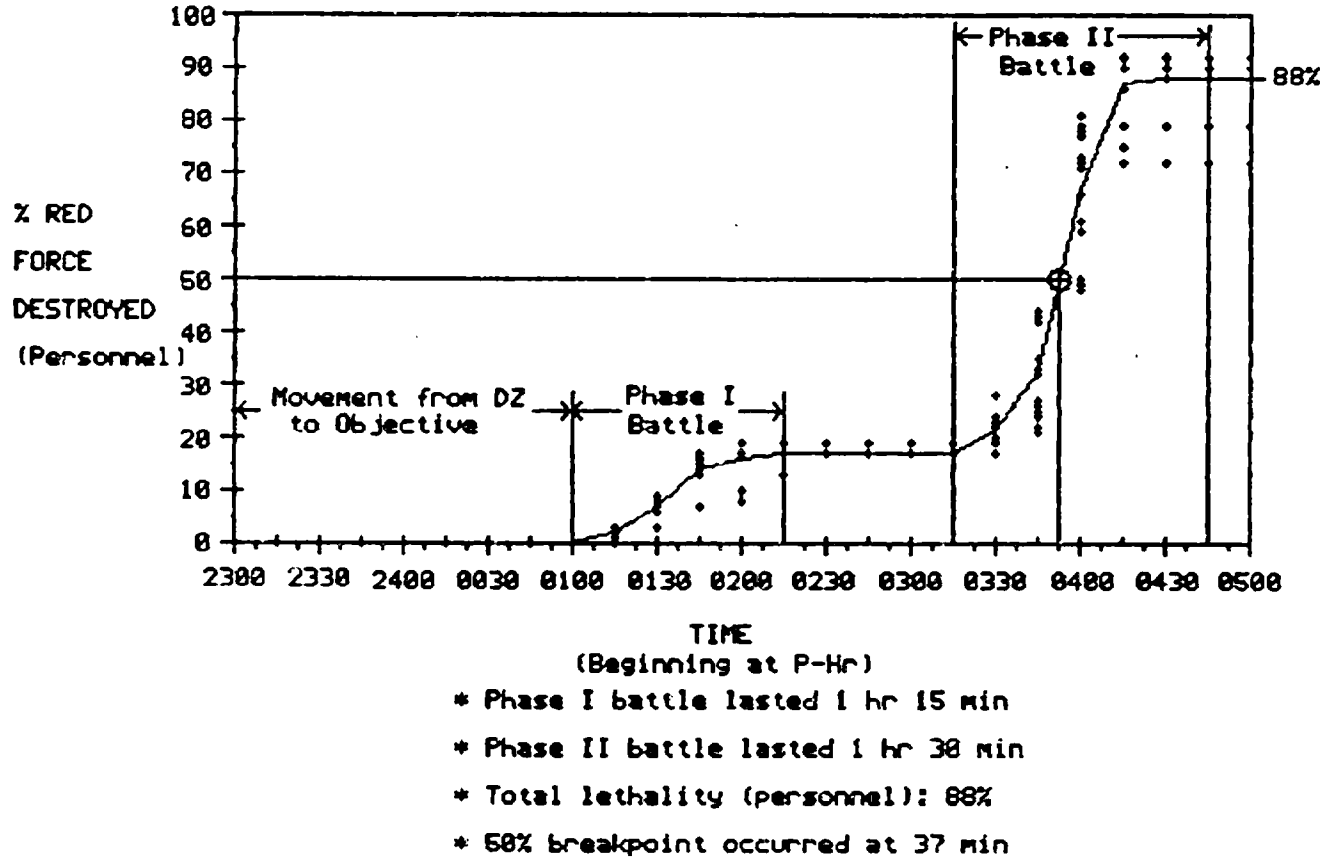


Figure 16. EMAB Personnel Lethality Results

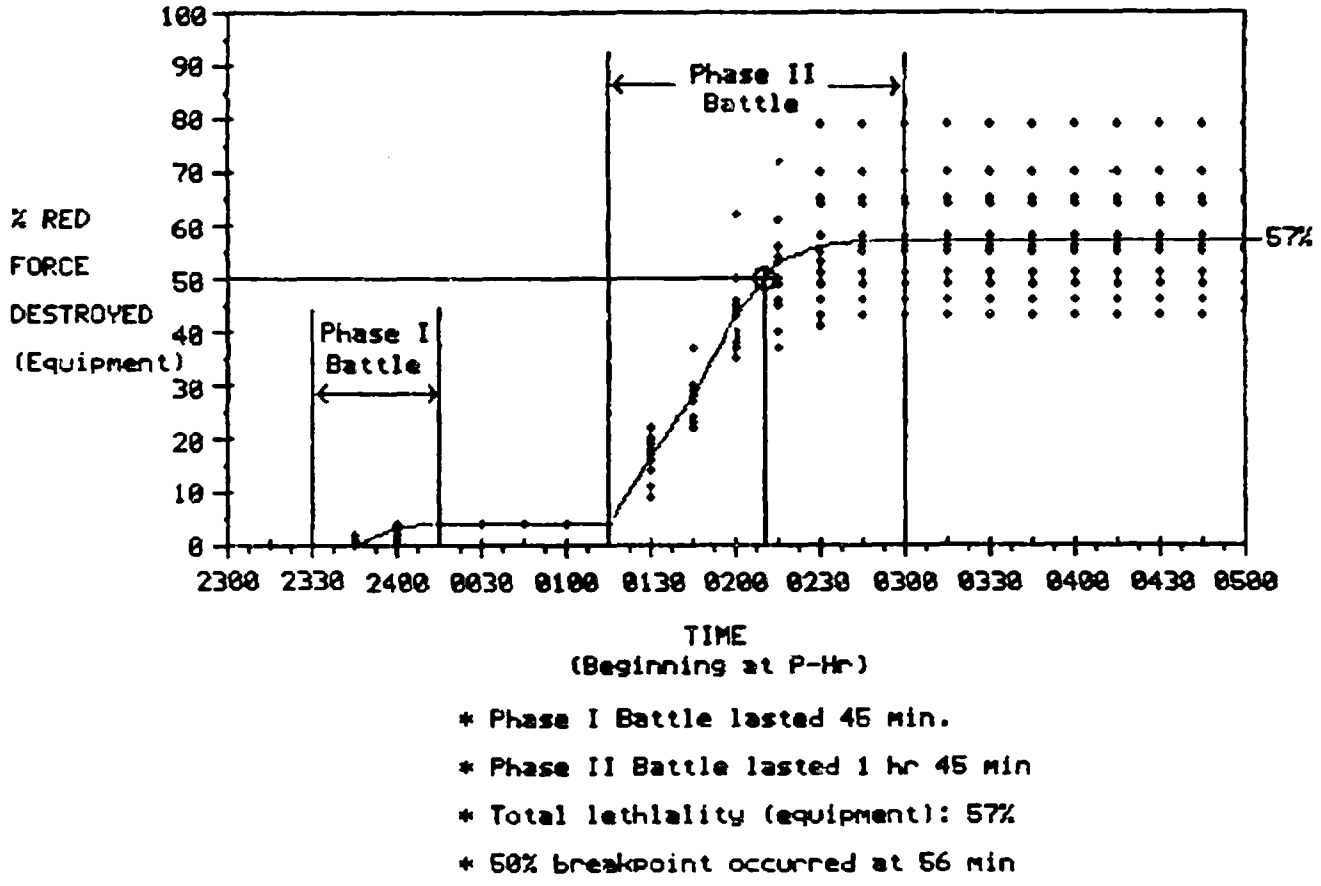


Figure 16. DRB (Medium) Equipment Lethality Results

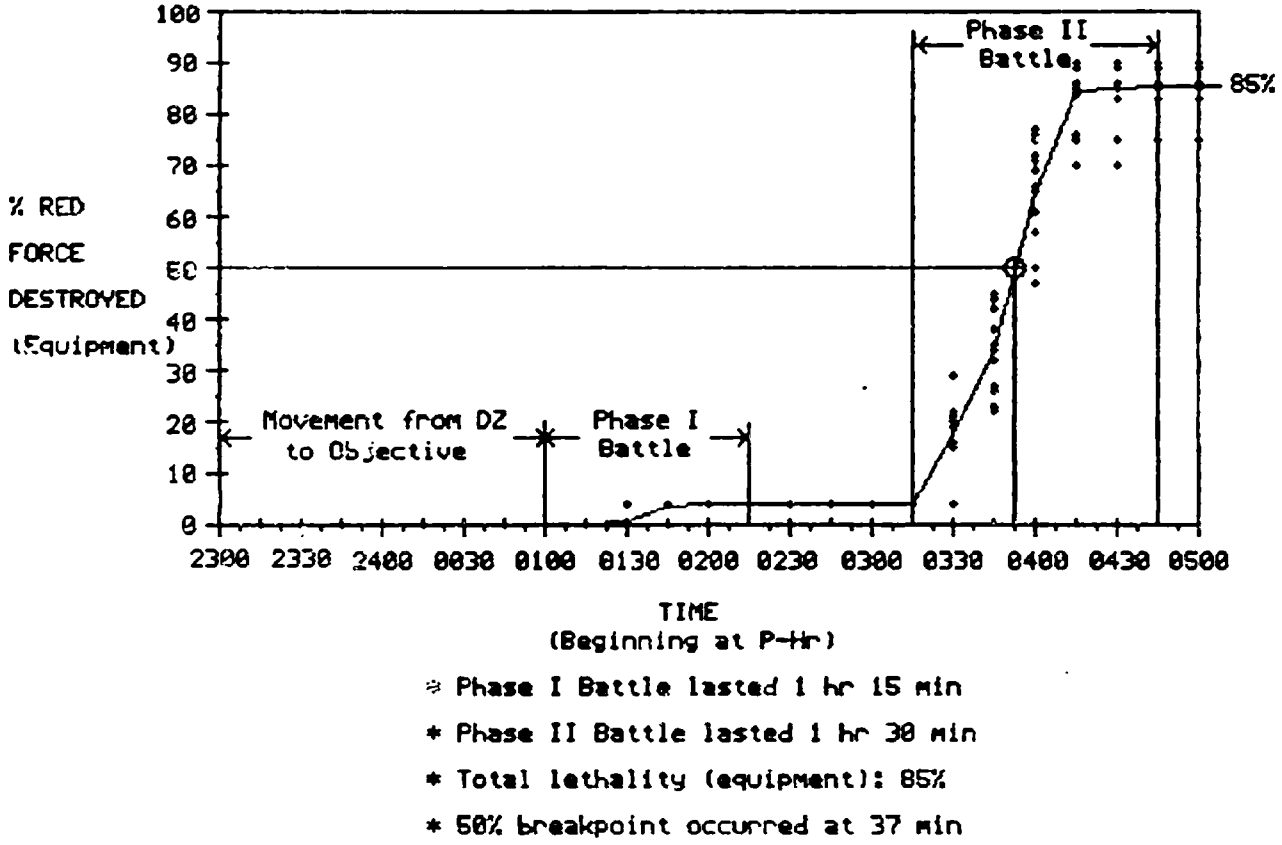


Figure 17. EMAB Equipment Lethality Results

enemy. This resulted in a large personnel lethality rate against Red personnel as indicated by the average of .4% Red personnel losses per minute (3.0 Red personnel casualties per minute).

The DRB (Medium) did not experience any significant difficulty destroying the armored personnel carriers at the airfield. Dragon and AT-4 missiles accounted for the majority of the BTR-60P kills. This resulted in an average equipment lethality rate against Red equipment equal to .27% Red vehicle losses per minute (.22 Red vehicle losses per minute).

However, due to the small number of long range anti-armor systems, the DRB (Medium) experienced some difficulty in defending against the Red mechanized battalion task force. The majority of Red vehicle casualties resulted from TOW missiles. But, since the DRB only had 14 HMMWV (TOW) vehicles, it could not successfully destroy all of the enemy armor and prevent the Red forces from closing with and decisively engaging the infantry. Consequently, every battle resulted in close combat between the opposing forces. As this happened, the DRB's large infantry strength was an asset. Unfortunately, infantry combat of any kind also increased the DRB's personnel casualty rate. During Phase II, the DRB's average personnel lethality rate against Red personnel was .59% Red personnel casualties per minute (4.5 Red personnel casualties per minute) and the average vehicle

lethality rate against Red vehicles was .5% Red vehicle kills per minute (.41 Red vehicle losses per minute).

Enhanced Mobility Airborne Force

The Enhanced Mobility Airborne Force took longer to seize the airfield than the DRB. On average, it required one hour and fifteen minutes to complete the Phase I battle. The smaller infantry strength was a handicap. In order to generate the necessary combat power to destroy the enemy company, the EMAB had to concentrate its firepower and limited number of infantrymen against only a portion of the enemy force at a time; instead of attacking all enemy units simultaneously like the DRB (Medium) did. This prolonged the battle for the airfield. In an effort to capitalize on the inherent speed of motorized infantry, and in order to get the Blue infantry as close as possible to the Red infantry before dismounting, the EMAB attacked mounted until it reached small arms range (300 to 500m) of the Red positions. Unfortunately, the thinly armored HMMWV squad carriers were vulnerable to machine gun fire while attempting to close with the entrenched enemy positions. The AGSs and the LCAS 25mm chain gun assisted by suppressing the enemy infantry so that the motorized units could successfully close. Indirect fire, particularly 155mm HE and DPICM, proved to be the greatest asset in overcoming the shortage of Blue infantry. It effectively suppressed the Red units so that the mobile units could close with and

assault the enemy positions without suffering heavy losses. During Phase I, the overall average personnel lethality rate for the Enhanced Mobility Airborne Battalion was .23% Red personnel casualties per minute (1.7 Red personnel casualties per minute). The average equipment lethality rate was .27% Red vehicle kills per minute (.22 Red vehicle losses per minute).

The EMAB was very effective against the Red mechanized battalion task force. The EMAB, in all but one run, destroyed the Red forces before the R d forces could close with the EMAB defenders and dismount for close combat. The twenty TOW launchers (LCAS) were the most significant vehicle killers. The Enhanced Mobility Airborne Battalion personnel lethality rate during Phase II was .78% Red personnel casualties per minute (5.9 Red personnel casualties per minute). The EMAB Phase II equipment lethality rate was .9% Red vehicle kills per minute (.74 Red vehicle losses per minute).

Several interesting phenomena were observed during the EMAB Phase II battle. Although the LCAS performed well, it was hampered by its limited missile load (only 4 rounds compared to the six rounds of the HMMWV). The difference could be critical in certain situations; since, this caused the LCAS to stop and reload missiles three times for every two reloads for a HMMWV (TOW). This had the net effect of reducing the overall TOW firing rate. To some degree, the

LCAS's 25mm chain gun, offset the effects of the reduced TOW firing rate. It was very lethal against lightly armored vehicles and personnel at close range. The EMAB's 155mm artillery, firing dual purpose improved conventional munitions (DPICM), significantly increased the lethality of the EMAB during Phase II. Since DPICM is effective against armored vehicles, this EMAB capability was much more useful than the DRB's limited 105mm artillery.

The fourteen thinly armored AGSs, armed with a 105mm gun, performed relatively poorly. In the open terrain, the Red force anti-armor missiles, mounted on the ten BRDMs and thirty-nine BMPs, were able to out range the AGS. The AGS performed best when it fired in terrain which limited long range fires; such as when employed in a reverse slope defense. Although, the AGS units were employed in this manner, they still suffered heavy losses since this tactic only afforded them the first shot. The Red force's return fires were usually devastating.

Force Survivability

Although the Blue force survivability percentages for personnel and equipment were essentially the same for both alternatives, the actual numbers of casualties were very different. Figures 18 to 21 contain charts depicting the survivability results. The DRB lost 13% of its combat personnel and 19% of its major weapon systems. This equates to the loss of 226 DRB personnel casualties (KIA/WIA) and

the loss of 18 major weapon systems. The EMAB lost 15% of its combat personnel and 25% of its major weapon systems. This equates to the loss of 120 EMAB personnel (KIA/WIA) and 25 of its major weapon systems.

These differences in survivability are significant. The DRB lost an average of 1.9 times as many personnel as the EMAB. If we combined these results with those of the aircraft survivability analysis, the DRB could have lost 634 personnel or 5.3 times as many personnel as the EMAB. Equipment, in both alternatives, appeared to be equally survivable. Appendix B contains the survivability results.

Sustainment Data

According to planning figures listed in Field Manual 101-10-1/2, "Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors (Volume 2)", the EMAB would need 43% fewer STONS of major weapon systems ammunition (class V) and bulk fuel (bulk class III) per day than the DRB. Figure 22 contains a chart which depicts the sustainment requirements. Total class III/V consumption requirements were 213 STONS/day for the DRB and 121 STONS/day for the EMAB. Even though the EMAB (155 vehicles) had fewer numbers of vehicles than the DRB (187 vehicles), the EMAB(4909 gallons/day) used 2.3 times as much bulk fuel as the DRB (2172 gallons/day). This equates to a difference of 8.6 STONS/day for Class III. The EMAB's greater daily bulk class III requirement was significantly offset, though,

by its much lower daily major weapons systems class V consumption (EMAB: 105 STONS/day, DRB: 205 STONS/day). The eighteen 105mm howitzers (169 STONS) are responsible for the bulk of the DRB(Medium)'s high ammunition consumption.

The overall reduction in bulk fuel and major weapons systems ammunition required by the EMAB, versus the DRB (Medium), is significant. Each C-17 will be able to airdrop a maximum of 40 one ton containerized delivery system (CDS) bundles.[20] Using the calculations, the EMAB would need only 2.6 C-17s per day for resupply of bulk fuel and major weapons systems ammunition versus the 5.2 C-17s needed by the DRB. It is important to remember that only bulk fuel and major weapons systems ammunition consumption were analyzed. If barrier material requirements, daily food and water, spare parts, and packaged petroleum products consumption were compared, the savings in daily resupply aircraft would probably increase. Appendix B contains the sustainment results.

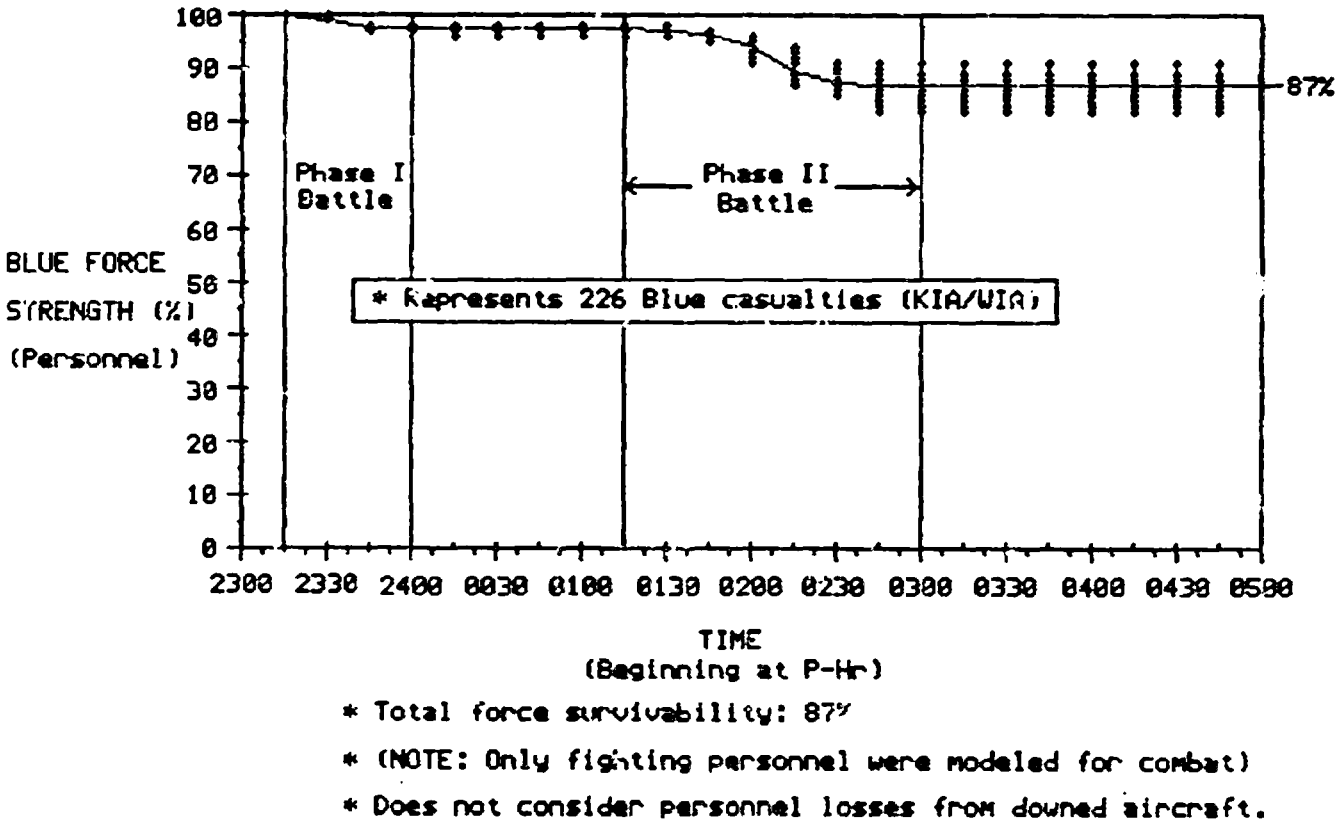


Figure 18. DRB (Medium) Personnel Survivability Results

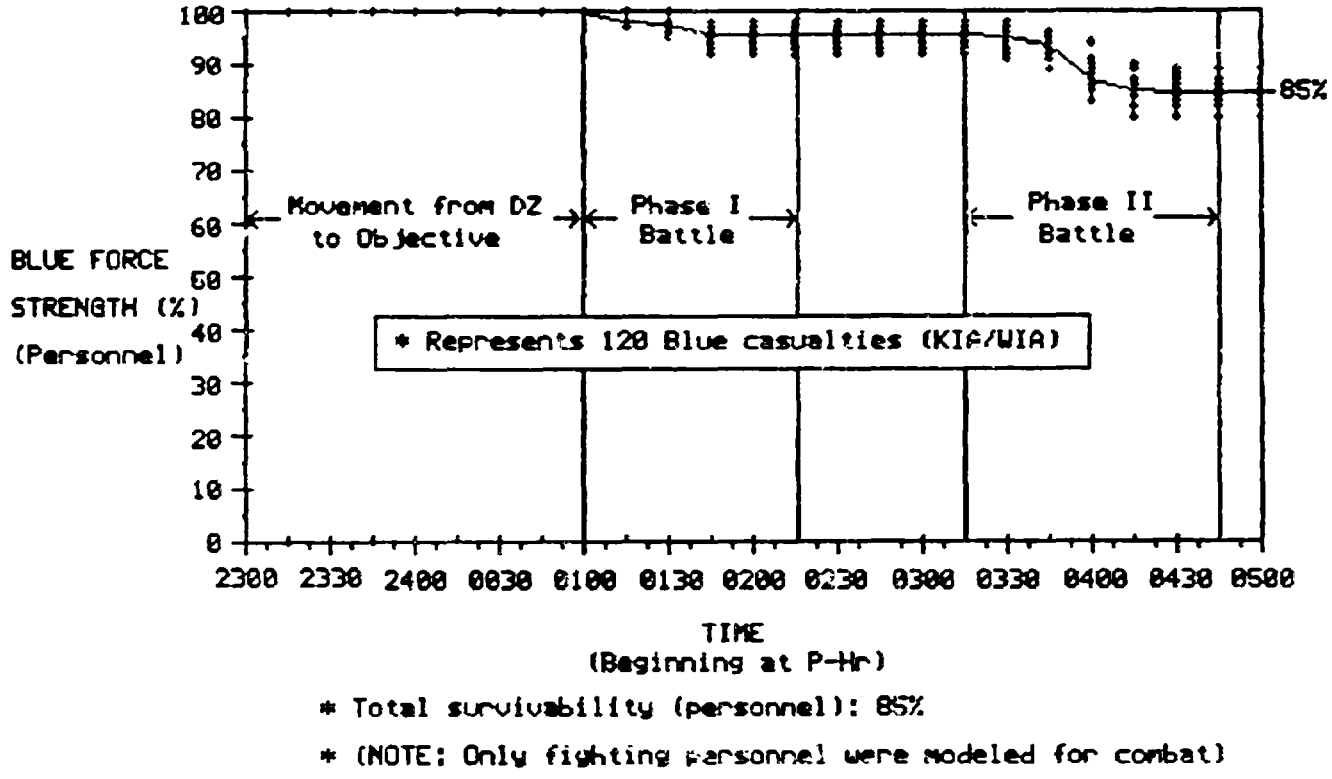


Figure 19. EMAB Personnel Survivability Results

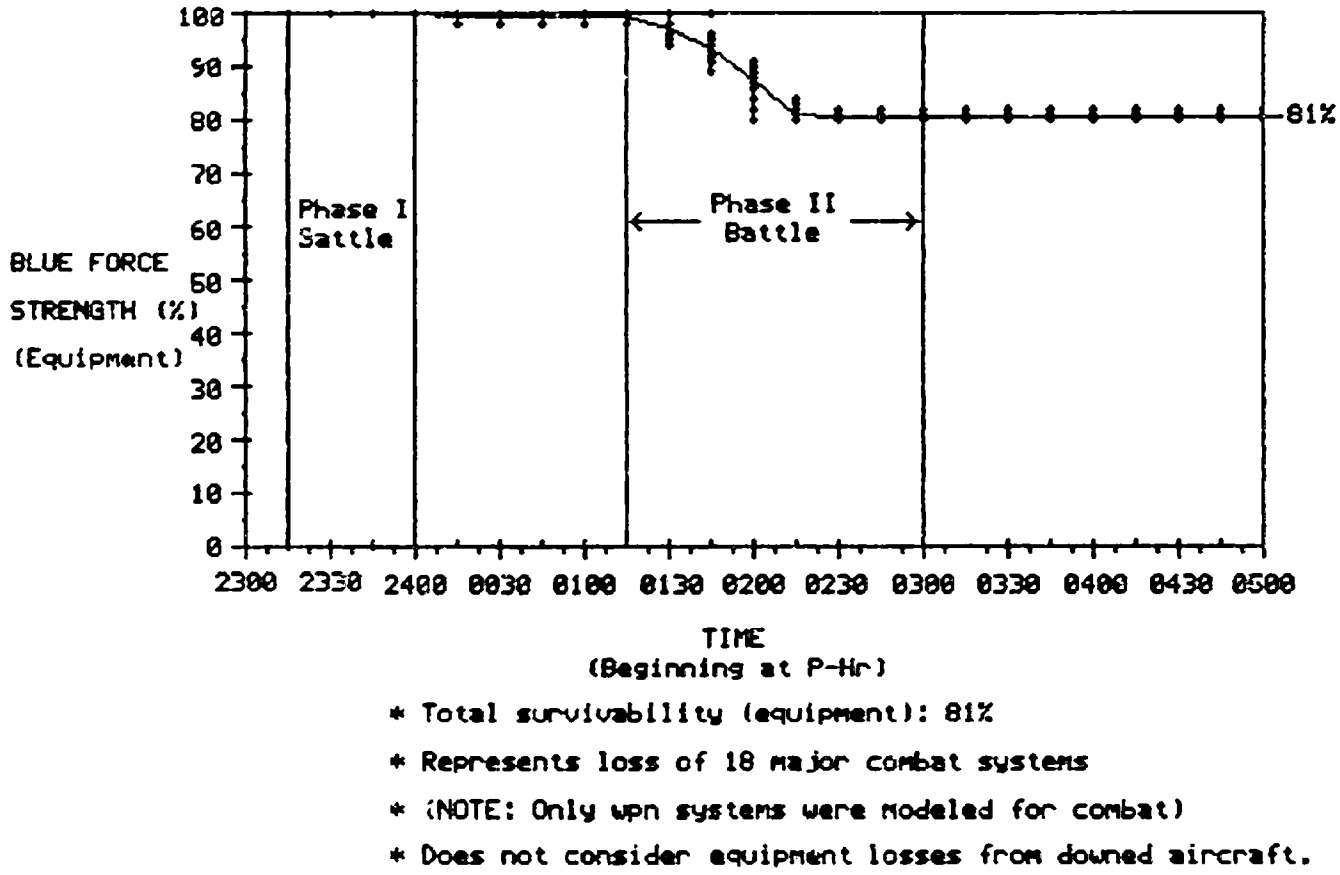


Figure 20. DRB (Medium) Equipment Survivability Results

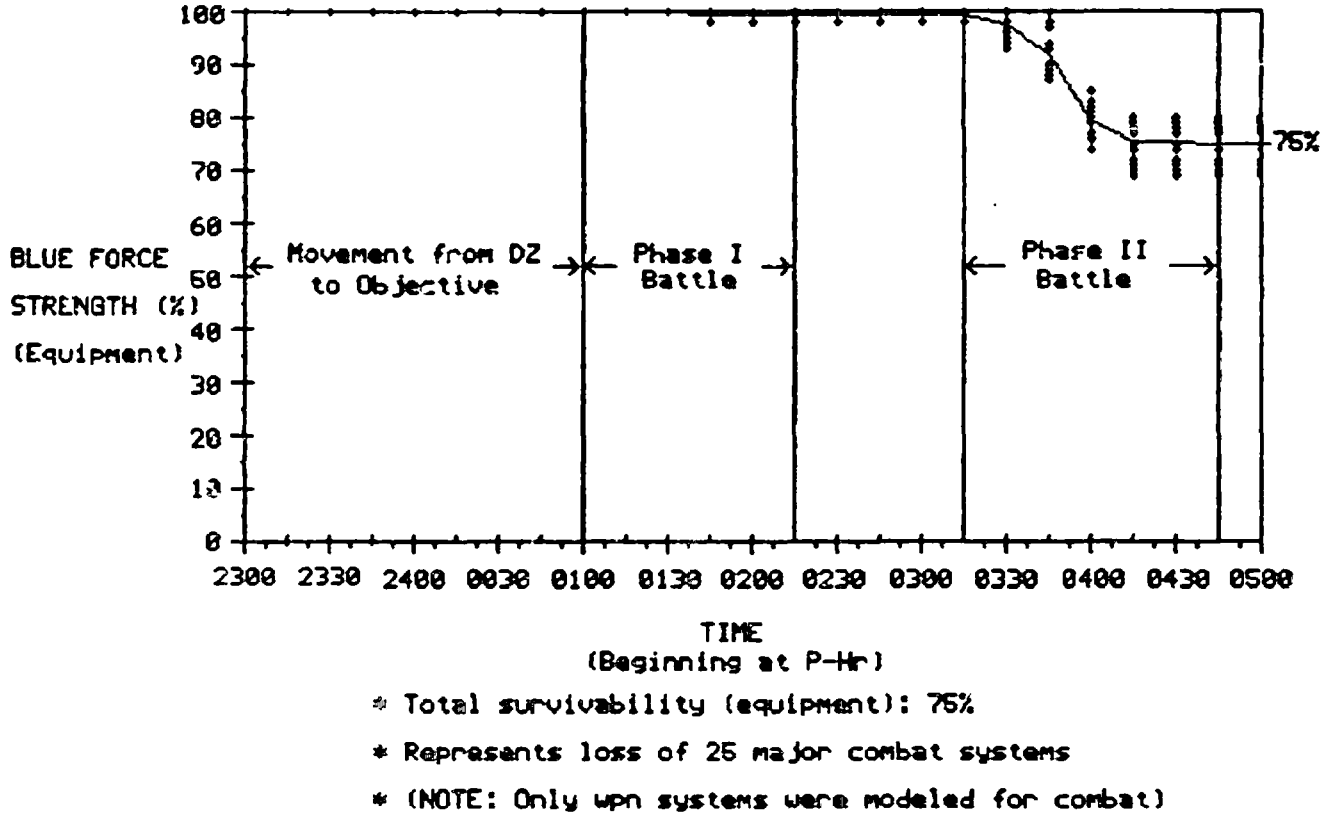


Figure 21. EMAB Equipment Survivability Results

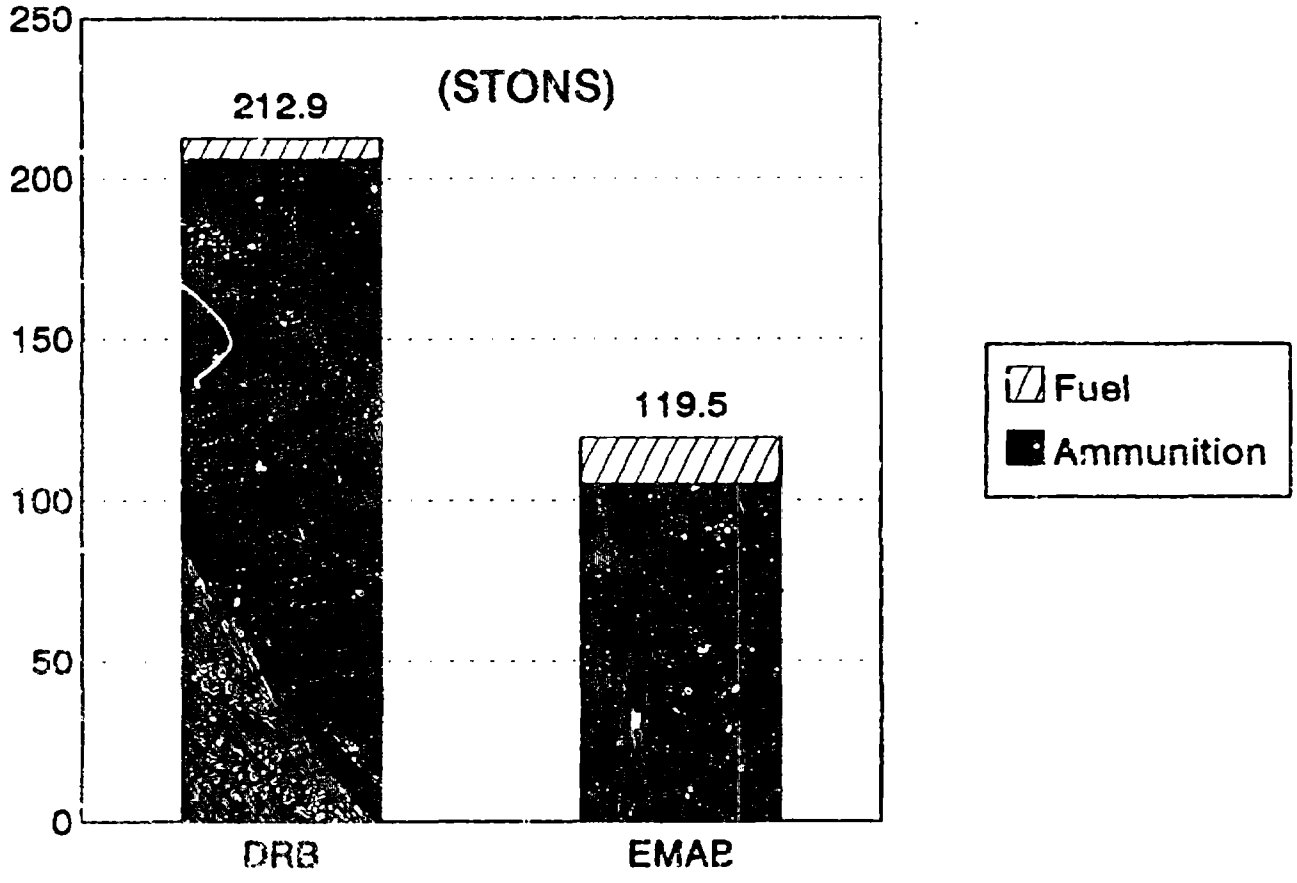


Figure 22. **Sustainment Requirements**

CHAPTER 5

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Conclusions

The results of this study support the creation of the Enhanced Mobility Airborne Battalion (EMAB) as a valid modification to the Army structure. Although it is unsuited as a total replacement for the DRB (Medium), it possesses unique capabilities which could provide the airborne division with a viable alternative to parachuting directly on the objective. The answers to the subordinate research questions support this conclusion.

The first subordinate question asked what a replacement force structure would look like. The proposed EMAB structure, used in this study, is a well balanced, combined arms force. It augments a standard airborne infantry battalion Tables of Allowances and Equipment (TOE) with enough personnel carriers to provide complete tactical mobility, and replaces the HMMWV (TOW) with an enhanced lethality platform. Combined arms task organization is achieved through the attachment of an AGS company, 155mm (Towed) artillery battery, an engineer company, and an ADA platoon. All of these units are completely mobile and constitute a valid military organization for combat.

The second question addresses the airlift requirements of the proposed EMAB. Although using 83 C-17s to transport the EMAB would constitute the dedication of 69% of the future C-17 force of 120 aircraft, it compares favorably to the 78 C-17s needed by the DRB (Medium). Unfortunately, the EMAB does not alleviate the potential C-17 shortage/readiness problem identified in Chapter 1. If it became too difficult to quickly marshall 78 C-17s for a contingency mission, 83 C-17s will be out of the question. Available airlift is always a limiting factor in contingency planning. However, the EMAB, like the DRB (Medium), could be task organized for an operation based on the mission, enemy, terrain, troops available, and time. It is probable, though, that the advantages of the EMAB would be quickly dissipated through any deletions to the task organization. A reduction in infantry strength could especially have a significant impact on the EMAB's chances of success.

Could the EMAB's combined increases in lethality and mobility offset the effects of a reduced infantry strength? The answer is situational dependent. The DRB (Medium), because of its large number of infantrymen, was much more effective than the EMAB when fighting infantry units in both Phases I and II. Even though the EMAB is 100% mobile, it has only 33% of the infantry strength of the current DRB (Medium). Using its superior firepower, the EMAB was able to compensate, to some degree, for its reduced infantry

strength by massing its firepower and attacking only portions of the defense at one time. However, this process almost doubled the time (1 hr, 15 minutes vs. 45 minutes) needed to secure the airfield, and speed is one of the most critical elements of an airfield seizure mission.

There are certain situations where there is no substitute for having large numbers of infantrymen. Combat operations, such as fighting in built-up areas like cities, towns, wooded or rough terrain, cannot be successfully fought without a preponderance of infantrymen. Although force ratios are not the sole factor in determining the success of infantry combat, they are still critical. Everything else being equal, large infantry units tend to defeat smaller infantry units.

However, the outcome of every battle is not always determined by the success or failure of infantry combat. In fact, there are some situations where infantry, by necessity, plays a supporting role. In armored battles fought in open terrain, the dismounted infantry's chief function might be limited to providing security to the more lethal antiarmor weapons. In such a scenario, if the attached infantry is not as mobile as the force it protects, or the enemy it opposes, it could become a liability.

This situation existed in the scenario used in this study, and the EMAB was unquestionably superior to the DRB (Medium) in fighting an armored/mechanized threat. Because

the EMAB destroyed the Red forces before the enemy could close with the EMAB's infantry, overall friendly losses were almost half as those experienced by the DRB (Medium).

Based on the results of this study, the enhanced mobility and lethality of the EMAB was found to be a satisfactory substitution for a reduction in infantry strength only in specific situations. When facing an armored/mechanized threat or an attack against a well defended airfield, the EMAB is a more viable force than the DRB (Medium). Coupled with the potential losses for a DRB (Medium) assault directly on a well defended objective, the EMAB offers the commander a much more survivable option to the current force. Keeping casualties to a minimum is a key consideration in military planning, and one our nation has come to expect. On the other hand, the DRB (Medium) unquestionably remains a more appropriate force for infantry intensive operations.

This conclusion must be balanced against several factors. The lethality and survivability results of the EMAB and the DRB (Medium) could have been different had certain conditions existed. If the DRB (Medium) had lost the large numbers of casualties predicted in the aircraft survivability analysis, it is likely that the infantry capability gap between the two alternatives would be narrowed. Additionaly, the DRB (Medium) landed in very close proximity to the defenders. If this had not been the

case, as in a misdrop off the DZ, the time needed to secure the airfield would have increased. If the DRB (Medium) had task organized to bring more HMMWV (TOW)s and AGSs, it probably could have come closer to the EMAB equipment lethality level. However, by doing so, this would have only increased the DRB (Medium)'s antiarmor lethality and would not have increased its capability to jump away from the objective. Finally, the addition of the armed scout helicopters would have had a significant impact on the results for both forces.

Subordinate question number four addressed the differences in logistical requirements between the two alternatives. Analysis of the results demonstrates that the EMAB is more logistically supportable than the DRB (Medium). Its single motorized battalion task force structure would require almost 43% less logistical support than the three infantry battalion DRB (Medium). Although the EMAB requires considerably more fuel, it only needs half of the ammunition that the DRB does. Ammunition made up the bulk of each units daily class III/V requirement.

The strengths and limitations of the EMAB are evident. Its increased mobility and firepower gives it several distinct advantages, over the DRB (Medium), in situations where maneuver is crucial. The EMAB's speed gives it a tactical agility, in some scenarios, which far surpasses that of the DRB (Medium). Yet, the analyses also

show that there are definite situations where having numerically superior infantry strength is preferable to having greater mobility. The EMAB is not well suited for operations where success depends on sheer infantry combat power and its enhanced mobility cannot be employed as a combat multiplier.

The EMAB's greatest advantage is its capability to parachute some distance away from a defended objective and still maintain surprise and the initiative. The results of the aircraft survivability test highlight the necessity to be able to execute this option. The average loss of four transports, along with their cargo of parachutists and equipment, would be considered a serious penalty for securing a lodgement in any contingency scenario. Even if the U.S. forces achieved a spectacular victory, their triumph would be undoubtedly tarnished by such a severe loss. As severe as four aircraft losses may seem, actual losses could be greater. It is important to remember that only eight SAMs were fired during the aircraft survivability test. Once those missiles were expended, all remaining transports were guaranteed to survive. Obviously, the losses would had been greater had there been more missiles to fire or if AAA had survived the pre-assault fires.

Implications

In this study, the EMAB and DRB were compared using only one scenario and one mission. Although it is difficult to draw firm conclusions from this one study, we can reasonably postulate on the feasibility of using the EMAB in other scenarios and missions. In addition to providing the first real capability to drop away from the objective, the EMAB has the potential to enhance the airborne force's ability to conduct noncombatant evacuation operations (NEO), economy of force operations, and deep attack missions.

In addition to airfield seizure missions, NEO is probably the most likely mission for an airborne force. Historically, one of the chief problems of a NEO has been getting sufficient transportation assets to quickly and securely transport the troops to the NEO collection points and bring the evacuees back to the departure airfield. Consequently, the force must rely on helicopters, limited tactical transport, and local national vehicles. These means of transport are fraught with potentially serious problems. If the host country opposes the NEO (non-permissive NEO), then obtaining local national transport can be difficult. Helicopters may not be able to fly if the weather is bad. The vehicles brought in to support the DRB transport mission essential supplies and equipment and these vehicles can rarely be spared for other missions. Time is critical during a NEO. Once U.S. forces arrive, all

evacuees must be quickly secured to insure that they are not harmed by alert and hostile forces. The EMAB could provide the speed, protection, and transport necessary to deter aggression, and safeguard the evacuees.

The EMAB could also give the airborne division an increased capability to better respond to missions like Operation *Desert Shield*. The JCS deployed the 82d Airborne Division to Saudi Arabia in 1990 because it was the most responsive and deployable contingency division; in spite of the obvious unsuitability of the Division to defend against armored forces in open terrain. Risk was assumed in the interest of speed. Although the Division is well trained, led and motivated, it nonetheless was ill-suited to defeat an attack by armored forces; since it lacked the ability to maneuver quickly. The Division would have been more capable had it possessed greater tactical mobility.

To remedy this shortcoming, the Army is fielding the light cavalry regiment (LCR). The mission of the LCR will be to provide contingency forces with a rapidly deployable capability to conduct reconnaissance and security operations.[29] In the future, the LCR will probably deploy in a *Desert Shield* scenario as part of, or in lieu of the 82d Airborne Division. Although this will be a mission for the new LCR, the EMAB could perform it better for two reasons. First the EMAB would be more deployable than a squadron of the LCR because it would use far less airlift.

The objective force design for the LCR is equipped with M113 personnel carriers rather than HMMWVs.[30] M113s, much heavier than HMMWVs, would by themselves make the force significantly less deployable by air.

Secondly, and most importantly, the LCR cannot conduct a forced entry. Like all other non-airborne forces, the LCR will require a secure lodgement so that it could airland in theater. If we used a *Desert Shield* scenario as a hypothetical situation for contingency planning, it might be an overly optimistic assumption to believe that the airfield will remain secure while the LCR deploys. The EMAB, on the other hand, could deploy prepared to conduct a parachute assault, and depending on the situation, either airdrop or airland. Such a force would provide the contingency planners with greater flexibility.

Deep attack, an attack directed against specific enemy forces in depth, who threaten the success of the friendly forces,[31] used to be one of the primary missions of the airborne division. In the last thirty years, it has ceased to be feasible due the vulnerability of the airborne force to the modern threat. Although the 82d Airborne Division, through its presence in Saudi Arabia alone, constituted a deep threat to the Iraqi forces, it probably would never have been employed in such a manner. The one large, cross front line of troops (FLOT) attack, by the 101st Air Assault Division, was an air assault using

helicopters. Unless its lethality and mobility are increased, it is hard to envision the future use of an airborne force in such a high risk operation.

An EMAB could make such an operation, not only feasible, but desirable. Maximizing its surprise and speed, the proposed airborne force could airdrop, assemble, and quickly attack at the enemy center of gravity. Using improved aerial resupply procedures, the force could abandon the DZ and relinquish its traditional requirements to defend the airhead. Instead, it could strike out at the enemy without surrendering the initiative. This capability would give the U.S. Army greater deep attack capabilities, and force the enemy to expend more troops to safeguard his rear areas.

Recommendations

The airborne division must undergo more and varied assessments to determine the best way to increase its tactical mobility and develop viable options to parachuting directly onto airfields. With the increased lethality and sophistication of third world threat armies, the U.S. military establishment cannot afford to do otherwise. It is very probable that the USAF will lose aircraft on a future airborne assault if the U.S. Army and Air Force do not improve their capabilities and change their tactics, techniques, and procedures. Victory will not be complete if they pay too high a price for it. To preclude this

situation, the U.S. military must explore other ways to conduct airborne assaults. The Enhanced Mobility Airborne Battalion provides one alternative.

Based on the test data and the results of the subordinate research questions, the Enhanced Mobility Airborne Battalion proved that it might be a viable addition to the airborne division force structure. Its increased tactical mobility and lethality could significantly increase the commander's range of options for employing an airborne force; while at the same time enhancing the airborne force survivability by dropping some distance away from a defended airfield.

The EMAB concept displays a lot of potential, but more evaluations must be done before it can be fully endorsed. Using the scenario and assumptions given, the EMAB performed well; but it alone, is insufficient proof of the merits of an alternative force. More studies must be undertaken to confirm these initial findings, and to determine the true limitations of the force.

More lethality tests should be made using multiple scenarios and varied terrain to determine the EMAB's actual capabilities and limitations. Long range weapons and mobility considerations are optimized in desert terrain. The EMAB would probably not be as effective in jungle, wooded, or urban terrain. Also, it fights best against a motorized/mechanized/armored threat. It needs to be

evaluated against an enemy comprised of predominately infantry. Scenarios requiring NEO, economy of force, and deep attack must also be studied before a credible assessment can be made.

If additional studies validate the creation of the EMAB, then equipment must be developed to support the concept. The HMMWV was used for this study because FMC produced two test variants, the LCAS and the squad carrier, which fit the requirement. The existence of these two vehicles greatly simplified the investigation of the primary research question. System requirements such as weapons, range, payload, and suspension would need to be studied to determine the optimal design. For example, the best squad carrier could be a small tracked vehicle. Yet, it must be emphasized that any drastic increases in weight or volume from a HMMWV would increase the airlift requirement, and possibly render the concept invalid.

Additional studies should also be undertaken to determine how many EMABs would be needed in an airborne division. The ideal airborne division would consist of a mix of EMABs and airborne battalions in order to allow for flexibility and to maximize capabilities. Based on the initial lethality studies against infantry-heavy forces, there will probably always be a requirement for standard airborne infantry battalions. The ideal division structure

would provide for enough of both types of forces to insure redundancy, simplify command and control, and facilitate training.

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APPENDIX A AIRBORNE EQUIPMENT MODERNIZATION ITEMS

The following items of airborne/airlift equipment as of FY 92 were being developed, evaluated, or fielded. These pieces of equipment, if produced or modified for airdrop, could be particularly beneficial to the EMAB concept.

1. 60,000lb Airdrop System. This system permits the low velocity airdrop of heavy equipment loads weighing up to 60k lbs. This system is scheduled for operational use in FY 96.

2. Low Altitude Retro-Rocket System (LARRS). This system permits the airdrop of heavy equipment loads by aircraft flying at 300 ft above ground level (AGL) and up to speeds of 250 knots.

3. High Mobility Artillery Rocket System (HIMARS). HIMARS is the light forces equivalent of the MLRS. Successful firing tests have been conducted firing a six rocket pod off a 5T truck chasis. The chief advantage of this system was that it could be C-130 airtransportable. Due to budget considerations, this system may never be fielded. In truth, it would have been more feasible had the requirement been placed on it to be airdropppable.

4. Pedestal Mounted Stinger (PMS). Although this system, a combination Stinger AD missile launcher, .50 cal machine gun, and thermal sight, is being fielded, it was not designed to be airdroppable. Consequently, it may not be fielded in the 82d Airborne Division. In order for it to be feasible for use in the EMAB, it would need to be certified for airdrop.

5. Lightweight 155mm Howitzer. This towed artillery system, firing all types of existing 155mm ammunition and weighing less than 7,500 lbs, may not be fielded due to budget constraints. It would be particularly beneficial to the EMAB concept since it combines the firepower of the M-198, 155mm howitzer with the mobility of the 105mm howitzer.

APPENDIX B RESULTS

AALPS Results and Load Data

Mission: DRB (Medium) Airdrop

Delivery Method	Aircraft Type	Sortie Qty Ratio	Mission ACL (lbs)	Quantity Loaded
ad	C-17	1	150,000	55

LOAD LIST

Item	Quantity	Nomenclature
i1	2195	Personnel
i1044	12	M119 how lt towed
i121	1	M105 trl Cgo 1 1/2T
i159	2	platform 8 ft supply load
i173	1	M34A2 Trk Cgo w/wn
i2	4	M551 Sheridan Armd recon veh
i458	1	3-pl 13 whl roller/vp-4d vib pac
i48	1	Grader, rd mtz ded w/12 ft blade
i594	15	M1038 Trk Cgo HMMWV
i399	1	M569 trl/ comp, rcp, air,eng
i597	6	M996, Trk, Amb, HMMWV
i598	54	M998, Trk, Cgo. HMMWV
i920	1	950b Loadr Scoop type 1 (reduced)
i923	1	D5b Dozer type 2 (sectionalized)

Mission: DRB (Medium) Airland

Delivery Method	Aircraft Type	Sortie Qty Ratio	Mission ACL (lbs)	Quantity Loaded
tal	C-17	1	150,000	23

LOAD LIST

Item	Quantity	Nomenclature
i1	496	Personnel
i1044	6	M119 how lt towed
i1183	6	M1022 dolly set lift shelter
i124	4	M149a1 Trl Wtr
i133	1	M34A2 Trk Dmp, 2 1/2 T
i149	43	463L pallet (7500 lbs)
i170	1	M543A1, Trk, Wrkr, w/wn
i189	2	trk, lft, frk, rt, 5T
i39	1	M103A3 trl/ pu-619/m gen set ged
i399	1	M569 trl/ comp, rcp, air,eng
i41C	9	UH-60 Blackhawk helicopter
i420	7	OH-58 Kiowa helicopter
i49	3	M167, gun, AA, towed, 20mm
i593	1	M1037, Trk, cgo, HMMWV w/shelter
i597	12	M996, Trk, Amb, HMMWV
i598	66	M998, Trk, Cgo. HMMWV
i663	1	XM1048, trl/an/tpq-37 radar
i804	1	M929 Trk, Dmp, 5T, reduced
i826	1	aux grd pwr unit (AGPU)
i88	1	M887 Trk Cgo/ cmu-3 shop equipment
i887	2	M923 Trk 5T/tank and pump unit
i985	1	Trk lft frk rt 3T mlt6-2 oper
u212	10	M35A2, Trk Cgo/M105 trl Cgo
u246	1	M35A2, Trk Cgo/M149 trl tank Wtr
u295	6	M1038 HMMWV/M101 trl 3/4T
u335	2	M923A1 Trk Cgo 5T/M107A2 Trl Tank
u554	1	M998 Trk Cgo HMMWV/M101A1 Trl Cgo

Mission: EMAB Airdrop

Delivery Method	Aircraft Type	Sortie Qty Ratio	Mission ACL (lbs)	Quantity Loaded
ad	C-17	1	150,000	73

LOAD LIST

Item	Quantity	Nomenclature
i1	800	Personnel
i120	7	M101 Trl Cgo 3/4T
i121	4	M105 trl Cgo 1 1/2T
i124	7	M149A1 Trl tank Wtr
i131	17	M813 Trk Cgo 5T w/wn
i133	1	M342A2 Trk Dmp 2 1/2T
i154	100	A-22 airdop container
i173	9	M35A2 Trk Cgo w/wn
i2	14	M551 Sheridan Armd recon veh
i200	8	M-198 How towed 155mm
i458	1	3-pl 13 whl roller/vp-4d vib pac
i48	1	Grader, rd mtz ded w/12 ft blade
i597	10	M996, Trk, Amb, HMMWV
i598	100	M998, Trk, Cgo. HMMWV
i920	1	950b Loadr Scoop type 1 (reduced)
i923	1	D5b Dozer type 2 (sectionalized)

Mission: EMAB Airland

Delivery Method	Aircraft Type	Sortie Qty Ratio	Mission ACL (lbs)	Quantity Loaded
tal	C-17	1	150,000	3

LOAD LIST

Item	Quantity	Nomenclature
i1	100	Personnel
i1183	6	M1022 dolly set lift shelter
i133	1	M34A2 Trk Dmp, 2 1/2 T
i149	43	463L pallet (7500 lbs)
i189	2	trk, lft, frk, rt, 5T
i399	1	M569 trl/ comp, rcp, air,eng
i410	9	UH-60 Blackhawk helicopter
i420	7	OH-58 Kiowa helicopter
i804	1	M929 Trk, Dmp, 5T, reduced
i826	1	aux grd pwr unit (AGPU)
i985	1	Trk lft frk rt 3T mlt6-2 oper

Aircraft Survivability Results

Total Number of Aircraft: 55 X C-17
SAM Threat: 8 X SA-14 missiles
Time: 2300 Local
BMNT: 0500
EENT: 1900
Visibility: Clear
Ceiling: Unlimited

Repetition #	Number of Lost Aircraft
1	5
2	4
3	2
4	5
5	7
6	5
7	1
8	1
9	3
10	5
11	4
12	3
13	2
14	3
15	3
16	5
17	3
18	2
19	5
20	1
21	2
22	2
23	6
24	4
25	3
26	5
27	4
28	3
29	7
30	1

Mean Loss = 3.6 aircraft
Range of losses = 1 to 7 aircraft
Standard Deviation = 1.76 aircraft
95% Confidence Interval = 2.97 to 4.17 aircraft

Lethality Results (Personnel)

Unit: DRB (Medium)
Note: Numbers represent % Red personnel which are a casualty.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
2300	0	0	0	0	0	0	0	0	0	0
2315	0	0	0	0	0	0	0	0	0	0
2330	0	0	0	1	1	1	1	0	5	0
2345	18	18	15	17	18	18	13	18	18	18
2400	18	18	18	18	18	18	17	18	18	18
0015	18	18	18	18	18	18	18	18	18	18
0030	18	18	18	18	18	18	18	18	18	18
0045	18	18	18	18	18	18	18	18	18	18
0100	18	18	18	18	18	18	18	18	18	18
0115	18	18	18	18	18	18	18	18	18	18
0130	22	23	24	19	21	19	20	22	22	22
0145	25	26	39	31	23	24	28	27	26	28
0200	34	42	65	51	38	42	49	33	39	45
0215	52	59	74	69	48	56	60	47	66	73
0230	52	66	81	82	64	77	68	61	74	85
0245	62	84	85	83	75	81	70	70	75	85
0300	82	84	85	83	75	81	70	70	75	85

Repetition Numbers

Time	11	12	13	14	15
2300	0	0	0	0	0
2315	0	0	0	0	0
2330	1	2	1	0	6
2345	18	15	15	18	17
2400	18	17	17	18	18
0015	18	18	18	18	18
0030	18	18	18	18	18
0045	18	18	18	18	18
0100	18	18	18	18	18
0115	18	18	18	18	18
0130	22	21	21	23	20
0145	23	25	22	25	25
0200	43	37	42	37	33
0215	64	59	67	50	64
0230	76	73	70	76	76
0245	84	87	73	82	82
0300	84	87	75	82	82

Unit: EMAB
Note: Numbers represent % Red personnel which are a casualty.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
0100	0	0	0	0	0	0	0	0	0	0
0115	1	0	1	2	3	2	2	2	2	2
0130	7	3	7	6	8	6	7	8	7	7
0145	7	7	16	17	14	15	13	15	13	13
0200	10	8	17	17	17	17	17	17	17	17
0215	13	17	17	17	17	17	17	17	17	17
0230	17	17	17	17	17	17	17	17	17	17
0245	17	17	17	17	17	17	17	17	17	17
0300	17	17	17	17	17	17	17	17	17	17
0315	17	17	17	17	17	17	17	17	17	17
0330	17	17	24	24	28	24	28	19	20	23
0345	25	21	32	44	35	42	33	42	42	27
0400	73	50	79	72	49	66	77	72	78	81
0415	90	72	90	90	90	90	90	90	90	90
0430	90	72	90	90	90	90	90	90	90	90
0445	90	72	90	90	90	90	90	90	90	90
0500	90	72	90	90	90	90	90	90	90	90

Repetition Numbers

Time	11	12	13	14	15
0100	0	0	0	0	0
0115	2	3	3	2	3
0130	7	8	9	7	8
0145	15	17	17	17	17
0200	17	17	19	17	17
0215	17	17	19	17	17
0230	17	17	19	17	17
0245	17	17	19	17	17
0300	17	17	19	17	17
0315	17	17	19	17	17
0330	20	20	19	19	22
0345	27	22	24	43	26
0400	59	61	48	66	71
0415	86	75	79	90	92
0430	90	88	79	90	92
0445	90	88	79	90	92
0500	90	88	79	90	92

Lethality Results (Equipment)

Unit: DRB (Medium)
Note: Numbers represent % Red equipment which has been destroyed.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
2300	0	0	0	0	0	0	0	0	0	0
2315	0	0	0	0	0	0	0	0	0	0
2330	0	0	0	0	0	0	0	0	0	0
2345	2	0	0	0	0	0	0	0	0	0
2400	2	2	4	4	4	4	4	4	4	3
0015	4	4	4	4	4	4	4	4	4	4
0030	4	4	4	4	4	4	4	4	4	4
0045	4	4	4	4	4	4	4	4	4	4
0100	4	4	4	4	4	4	4	4	4	4
0115	4	4	4	4	4	4	4	4	4	4
0130	20	22	19	9	16	11	14	18	17	18
0145	28	30	37	27	23	24	29	27	30	30
0200	35	45	62	50	40	43	45	37	43	46
0215	40	53	72	61	49	61	50	37	53	56
0230	43	53	79	62	53	70	51	41	63	58
0245	46	56	79	65	56	70	51	43	56	58
0300	51	56	79	65	56	70	51	43	56	58

Repetition Numbers

Time	11	12	13	14	15
2300	0	0	0	0	0
2315	0	0	0	0	0
2330	0	0	0	0	0
2345	1	0	0	0	0
2400	4	4	4	1	2
0015	4	4	4	4	4
0030	4	4	4	4	4
0045	4	4	4	4	4
0100	4	4	4	4	4
0115	4	4	4	4	4
0130	17	17	16	20	14
0145	22	29	23	29	29
0200	38	39	44	40	38
0215	54	61	56	46	45
0230	55	64	58	46	49
0245	55	64	58	46	49
0300	55	64	58	46	49

Unit: EMAB
Note: Numbers represent % Red equipment which has been destroyed.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
0100	0	0	0	0	0	0	0	0	0	0
0115	0	0	0	0	0	0	0	0	0	0
0130	0	0	0	0	0	0	4	4	0	0
0145	0	4	4	4	4	4	4	4	4	4
0200	4	4	4	4	4	4	4	4	4	4
0215	4	4	4	4	4	4	4	4	4	4
0230	4	4	4	4	4	4	4	4	4	4
0245	4	4	4	4	4	4	4	4	4	4
0300	4	4	4	4	4	4	4	4	4	4
0315	4	4	4	4	4	4	4	4	4	4
0330	4	4	16	21	22	20	29	16	16	21
0345	26	23	34	45	38	42	85	35	45	32
0400	66	50	72	71	50	66	76	65	75	77
0415	85	70	85	89	86	90	90	86	86	86
0430	85	70	85	89	86	90	90	86	86	86
0445	85	75	85	89	86	90	90	86	86	86
0500	85	75	85	89	86	90	90	86	86	86

Repetition Numbers

Time	11	12	13	14	15
0100	0	0	0	0	0
0115	0	0	0	0	0
0130	0	0	0	0	0
0145	4	4	4	4	4
0200	4	4	4	4	4
0215	4	4	4	4	4
0230	4	4	4	4	4
0245	4	4	4	4	4
0300	4	4	4	4	4
0315	4	4	4	4	4
0330	20	16	15	19	21
0345	27	27	22	44	32
0400	57	61	47	66	69
0415	84	76	75	90	89
0430	89	83	75	90	89
0445	89	83	75	90	89
0500	89	83	75	90	89

Personnel Survivability Results

Unit: DRB (Medium)
Note: Numbers represent % total Blue personnel strength which have not become a casualty.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
2300	100	100	100	100	100	100	100	100	100	100
2315	100	100	100	100	100	100	100	100	100	100
2330	100	100	100	100	99	99	99	99	99	99
2345	97	98	97	98	98	98	97	97	98	98
2400	96	98	97	97	98	97	97	97	97	98
0015	96	98	97	97	98	97	97	97	97	98
0030	96	98	97	97	98	97	97	97	97	98
0045	96	98	97	97	98	97	97	97	97	98
0100	96	98	97	97	98	97	97	97	97	98
0115	96	98	97	97	98	97	97	97	97	98
0130	96	98	97	97	97	97	96	97	97	97
0145	95	97	97	96	97	96	96	95	97	96
0200	94	96	95	95	95	95	92	91	94	91
0215	91	93	91	94	88	92	89	87	88	87
0230	90	88	91	91	85	88	86	85	88	85
0245	89	88	91	91	82	88	86	84	88	85
0300	89	88	91	91	82	88	86	84	88	85

Repetition Numbers

Time	11	12	13	14	15
2300	100	100	100	100	100
2315	100	100	100	100	100
2330	99	99	99	99	99
2345	98	98	98	97	98
2400	98	98	98	97	98
0015	98	98	98	97	97
0030	98	98	98	97	97
0045	98	98	98	97	97
0100	98	98	98	97	97
0115	98	98	98	97	97
0130	97	97	97	96	97
0145	97	97	97	95	96
0200	96	96	95	91	93
0215	91	88	89	89	89
0230	88	87	85	87	89
0245	88	87	83	87	89
0300	88	87	83	87	89

Unit: EMAB
Note: Numbers represent % total Blue personnel strength which have not become a casualty.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
0100	100	100	100	100	100	100	100	100	100	100
0115	100	100	98	100	97	98	97	97	97	98
0130	98	100	98	100	97	98	97	97	97	96
0145	98	98	96	96	95	97	95	96	95	93
0200	96	98	96	96	95	97	95	96	95	93
0215	96	98	96	96	95	97	95	96	95	93
0230	96	98	96	96	95	97	95	96	95	93
0245	96	98	96	96	95	97	95	96	95	93
0300	96	98	96	96	95	97	95	96	95	93
0315	96	98	96	96	95	97	95	96	95	93
0330	96	98	96	96	95	97	95	95	94	92
0345	96	95	94	93	95	94	95	93	94	92
0400	91	94	89	87	89	88	86	86	86	83
0415	87	90	89	86	84	85	85	86	87	82
0430	87	88	89	86	84	85	85	86	87	82
0445	87	85	89	86	84	85	85	86	87	82
0500	87	85	89	86	84	85	85	86	87	82

Repetition Numbers

Time	11	12	13	14	15
0100	100	100	100	100	100
0115	97	98	97	98	98
0130	97	98	95	96	96
0145	96	96	92	94	94
0200	96	96	92	94	94
0215	96	96	92	94	94
0230	96	96	92	94	94
0245	96	96	92	94	94
0300	96	96	92	94	94
0315	96	96	92	94	94
0330	95	96	91	94	93
0345	95	96	89	91	93
0400	89	90	83	85	85
0415	83	84	80	84	84
0430	82	83	80	84	84
0445	82	83	80	84	84
0500	82	83	80	84	84

Equipment Survivability Results

Unit: DRB (Medium)
Note: Numbers represent % of total Blue equipment strength which is still operational.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
2300	100	100	100	100	100	100	100	100	100	100
2315	100	100	100	100	100	100	100	100	100	100
2330	100	100	100	100	100	100	100	100	100	100
2345	100	100	100	100	100	100	100	100	100	100
2400	100	100	100	100	100	100	100	100	100	100
0015	98	98	100	100	100	100	100	100	100	100
0030	98	98	100	100	100	100	100	100	100	100
0045	98	98	100	100	100	100	100	100	100	100
0100	98	98	100	100	100	100	100	100	100	100
0115	98	98	100	100	100	100	100	100	100	100
0130	97	98	100	100	94	98	95	98	100	96
0145	92	95	96	95	92	95	91	89	100	91
0200	87	87	90	89	87	91	82	80	90	86
0215	80	80	82	82	80	83	81	80	80	80
0230	80	80	81	80	80	82	80	80	80	80
0245	80	80	81	80	80	82	80	80	80	80
0300	80	80	81	80	80	82	80	80	80	80

Repetition Numbers

Time	11	12	13	14	15
2300	100	100	100	100	100
2315	100	100	100	100	100
2330	100	100	100	10[illegible]	100
2345	100	100	100	1[illegible]	100
2400	100	100	100	10[illegible]	100
0015	100	100	100	100	100
0030	100	100	100	100	100
0045	100	100	100	100	100
0100	100	100	100	100	100
0115	100	100	100	100	100
0130	95	96	98	94	98
0145	95	95	94	91	93
0200	90	91	88	84	89
0215	84	81	80	81	80
0230	81	80	80	80	80
0245	81	80	80	80	80
0300	81	80	80	80	80

Unit: EMAB
Note: Numbers represent % of total Blue equipment strength which is still operational.

Repetition Numbers

Time	1	2	3	4	5	6	7	8	9	10
0100	100	100	100	100	100	100	100	100	100	100
0115	100	100	100	100	100	100	100	100	100	100
0130	100	100	100	100	100	100	100	100	100	100
0145	100	100	100	100	100	100	100	100	100	100
0200	100	100	100	100	100	100	100	100	100	100
0215	100	100	100	100	100	100	100	100	100	100
0230	100	100	100	100	100	100	100	100	100	100
0245	100	100	100	100	100	100	100	100	100	100
0300	100	100	100	100	100	100	100	100	100	100
0315	100	100	100	100	100	100	100	100	100	100
0330	100	100	100	100	100	97	100	96	94	95
0345	97	89	90	88	98	87	100	87	94	94
0400	83	83	81	81	85	76	82	77	80	80
0415	80	71	80	78	71	72	78	77	78	79
0430	80	70	80	78	71	72	78	77	78	79
0445	80	69	80	78	71	72	78	77	78	79
0500	80	69	80	78	71	72	78	77	78	79

Repetition Numbers

Time	11	12	13	14	15
0100	100	100	100	100	100
0115	100	100	100	100	100
0130	100	100	100	100	100
0145	100	100	98	100	98
0200	100	100	98	100	98
0215	100	100	98	100	98
0230	100	100	98	100	98
0245	100	100	98	100	98
0300	100	100	98	100	98
0315	100	100	98	100	98
0330	96	98	94	97	93
0345	93	98	87	87	93
0400	79	79	76	79	74
0415	75	69	70	78	74
0430	75	69	70	78	74
0445	75	69	70	78	74
0500	81	80	80	80	80

DRB Medium Sustainment Results

DRB (Medium) Daily Class III (Bulk Fuel) Usage

Equipment	Rate	Qty	Usage Factor	Total
T61494 - HMMWV	.0497	121	62.5	376
T38707 - HMMWV	.0497	18	"	56
T61562 - HMMWV	.0435	21	"	57
T07543 - HHMWV	.0497	1	"	3.1
X40146 - M35A2	.1305	12	"	98
X40794 - 5T TRK	.1554	4	"	39
X63299 - Wrkr	.2237	1	"	14
X41633 - M887	.3791	1	"	24
X43708 - M35A2	.1429	2	"	18
X48914 - RT Frk Lft	6	1	12	72
X49051 - RT Frk Lft	6.5	2	12	156
AGS	Varied	4	Varied	1112
J74920 - Grader	2.7	1	12	32
W76268 - D5 Dozer	2.1	1	12	37
W76556 - Scoop Ldr	6.5	1	12	78
				2172

Total (from last column) = 2172 ga
Total (STONS) = 2172/ 317 = **6.9 STONS**

DRB (Medium) Daily Major Weapons Systems Class V Usage

Weapon	Qty	STONS/Wpn/Day	Total
105mm How	18	9.4	169.2
TOW missile	14	.296	4.1
81mm mortar	12	.892	10.7
AGS	4	.936	3.7
Dragon Missile	54	.06	3.2
7.62mm MG	54	.213	11.5
40mm M203	162	.013	2.1
5.56mm (SAW)	162	.003	.5
5.56mm	780	.002	1.56
			206

Total (from last column) = 206 STONS

DRB (Medium) Total = 6.9 + 206 = **213 STONS**

EMAB Sustainment Results

EMAB Daily Class III (Bulk Fuel) Usage

Equipment	Rate	Qty	Usage Factor	Total
T61494 - HMMWV	.0497	100	62.5	310
T38707 - HMMWV	.0497	10	"	31
X40146 - M35A2	.1305	9	"	73
X40794 - 5T TRK	.1554	15	"	146
X63299 - Wrkr	.2237	1	"	14
AGS	Varied	14	Varied	3892
X48914 - RT Frk Lft	6	1	12	72
X49051 - RT Frk Lft	6.5	2	12	156
J74920 - Grader	2.7	1	12	32
W76268 - D5 Dozer	3.1	1	12	37
W76556 - Scoop Ldr	6.5	1	12	78
				4909

Total (from last column) = 4909 ga
Total (STONS) = 4909/ 317 = 15.5 STONS

EMAB Daily Major Weapons Systems Class V Usage

Weapon	Qty	STONS/Wpn/Day	Total
155mm How	8	9	72
TOW missile	20	.296	6
81mm mortar	4	.892	3.6
AGS	14	.936	13.1
Dragon Missile	18	.06	1.1
7.62mm MG	18	.213	3.9
40mm M203	54	.013	.7
40mm Mk-19	36	.11	4
5.56mm (SAW)	54	.003	.16
5.56mm	260	.002	.5
			105

Total (from last column) = 105 STONS

EMAB Total = 15.5 + 105 = 121 STONS

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